GENETIC RESISTANCE TO CERCOSPORA LEAFSPOT DISEASES IN PEANUT (*Arachis hypogaea* L.)

BY

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TO MY BELOVED MOTHER, PILAR, unfortunately dead,
WITH LOVE TO MY WIFE, RITA,
AND MY SONS, GUSTAVO, FERNANDO, AND CARLOS
TO A DEAREST FRIEND, MARIO VILLARROEL TERAN

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One hundred and seventy-eight peanut cultigens were tested for resistance to Cercospora leafspot diseases at two Florida locations (Gainesville and Marianna) in 1977. In 1978 and 1979, twenty-five cultigens selected in 1977 plus five F_6 generation lines from crosses between resistant and susceptible cultigens and the controls, Florunner and Florigiant, were evaluated.

Disease epidemics were monitored during the growing seasons. Observations were made on number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and visual disease estimates at two-week intervals. Ranking of cultigens was made on the basis of the above parameters.

Artificial inoculations of the cultigens were made in the greenhouse with spore samples of *C. arachidicola* and *C. personatum*, and a mixed sample of both pathogens.

A complete balanced mixed model with cross and nested effects was used for analysis. Variances, phenotypic and genotypic correlations, heritabilities, and responses to selection were calculated.

Disease progress curves of resistant cultigens did not follow straight logit lines, suggesting resistance based on, first, fewer lesions in resistant cultigens throughout the season, and second, a much reduced number of lesions near maturity (adult plant resistance).

The following cultigens appeared resistant to *C. arachidicola:* 306230, 196604, 109839, 196652, 196677, NC 3033, F_6-Florunner x 121067, and F_6-306230 x Florunner; and the following to *C. personatum:* 251893, 261906, 262090, 196658, 203397, 203396, 162539, and FESR-5.

Genotype-location interactions, within seasons, were detected for number of *C. arachidicola*-lesions in eleven cultigens and for number of *C. personatum*-lesions in seven cultigens. Genotype-season interactions, averaged over locations, were detected in five cultigens for number of *C. arachidicola*-lesions, and in fifteen cultigens for number of *C. personatum*-lesions. Most of the cultigens showed genotype-location or genotype-season interactions only for the number of lesions caused by the pathogen to which they were susceptible.

Negative phenotypic (-.28 to -.51) and genotype (-.50 to -.64) correlations were obtained for reactions between the two pathogens. Defoliation in the field was correlated more with *C. arachidicola* than with *C. personatum* infection.

High heritabilities were obtained for number of lesions (.70 to .93). The correlated response between the two pathogens in number of lesions, was large and negative. Probably the same set of genes influence the number of lesions in both pathogens, increasing one of them and reducing the other.

In the greenhouse drastic reductions in number of *C. personatum*-lesions (from 10.2 to 0.5 and from 50.7 to 3.6) were observed after inoculation with a mixture of spore suspensions of both pathogens compared with spore suspensions of *C. personatum* alone. Higher defoliation was induced with *C. arachidicola*- than with *C. personatum*-inoculum; but no relationship was apparent between the number of lesions and the amount of defoliation.

Useful resistance to Cercospora leafspot diseases exists among the cultigens studied and can be used in a breeding program. Number of lesions seems to be the most reliable method to assess resistance to Cercospora leafspot diseases. Identification of the lesions caused by each pathogen and the establishment of their proportion in the disease complex is a prerequisite for progress in selection of resistant lines.

INTRODUCTION

Two fungal species, *Cercospora arachidicola* Hori and *Cercosporidium personatum* (Beck and Curtis) Deighton, have been associated with leafspot diseases of peanuts.

The two pathogens are present in all regions where peanuts are cultivated. Reductions due to leafspot diseases of up to 50% of the yield have been estimated (Garren and Jackson, 1973). Their prevalence varies from region to region. In some countries, Indonesia, Philippines and Tanganyika, only late leafspot is considered important (Reyes and Romasanta, 1940; Gibbons, 1966); while in Malawi, Southern Rhodesia and United States the situation is reversed (Purrs, 1962, Rothwell, 1962). In most peanut-growing areas of the United States, early leafspot seems to be predominant (Miller, 1953); currently in Florida, however, late leafspot is becoming as important as early leafspot.

Leaf shedding is the most conspicuous expression of the disease. Mercer (1977) indicated that *C. arachidicola* caused complete defoliation of the plants; whereas Jenkins (1938), Hemingway (1955, 1957), and Gibbons (1966) stated that *C. personatum* caused more severe defoliation. None of the researchers presented data to support their observations.

Immunity and high resistance have been detected in *Arachis* species different from *hypogaea*, (Gibbons and Bailey, 1966; Abdou et al., 1974; Melouk and Banks, 1978). Crosses between such species and *A. hypogaea* have not succeeded because of incompatibility (Smartt and Gregory, 1967; Smartt et al., 1978a, 1978b). Efforts are being made to overcome this problem.

Several degreees of resistance have been observed among cultivated peanuts associated with various characteristics of the plant (Higgins, 1935; Jenkins, 1938, Aulakh et al., 1972). In all cases of reported field resistance to leafspot diseases, no differentiation of the causal agents nor their proportion in the disease complex was made. The relationship existing between the two pathogens, in the number or size of lesions and amount of defoliation caused by them, has not been documented. The extent of variability in the expression of the disease and the amount accounted for by genetic variation are not known, nor are the heritabilities of the characteristics of the disease. Data supporting the independence of inheritance of resistance to the two pathogens is likewise absent.

The main purpose of the study was to highlight the Cercospora leafspot resistance existent within *A. hypogaea* and determine its usefulness in a breeding program with emphasis on the differentiation of diseases caused by *C. arachidicola* and *C. personatum*. More specifically, three years of observations, scorings and analyses of the data on the performance of peanut cultigens under naturally occurring leafspot disease conditions were made to: 1) differentiate cultigens by their resistance to *C. arachidicola* and *C. personatum*-leafspots, 2) detect the percent of genetic variation that accounts for the observed variation in the peanut population, 3) determine the relationship between disease caused by the two pathogens and to leaf shedding, 4) seek the presence of genotype-location or genotype-season interactions, 5) estimate the heritabilities of disease assessment parameters and determine those most suitable for use in a leafspot resistance breeding program, and 6) characterize the level of resistance in the cultigens under test by monitoring the disease epidemic progress.

REVIEW OF LITERATURE

Leafspot in peanuts was first described by Berkeley (1875) as being caused by *Cladosporium personatum*.. Later, Ellis and Everhart (1885) assigned this pathogen to the genus *Cercospora (C. personata)*. Since then *Cladosporium personatum, Cercospora personata, Cercospora arachidis,* and *Septogloeum arachidis* were used as synonyms. Hori described *C. arachidicola*, for the first time, as another species causing leafspots in peanuts in 1917, and in 1933 Woodroof described the asexual stages of the two fungi. In 1967, Deighton assigned the species *Cercospora personata* to the genus *Cercosporidium*. Since then, the names *Cercospora arachidicola* and *Cercosporidium personatum* have been used as the causal agents for early and late leafspot, respectively.

The perfect stages of *C. arachidicola* and *C. personatum* were described by Jenkins (1938) under the names *Mycosphaerella arachidicola* and *M. berkeleyii*, respectively. The presence of these stages in nature seems to be a rare event. The conidial stages of the pathogens are considered the most important sources of inoculum for disease development.

All parts of the plant can be attacked by both pathogens, but lesions on leaflets and defoliation are the most outstanding features of the disease. The degree of infection and the degree of defoliation have been observed to be directly related, and several workers (Woodroof, 1933; Reyes and Romasanta, 1940; Miller, 1953; Hemingway,

1957) report that defoliation caused by *C. personatum* is more severe than that caused by *C. arachidicola*. McDonald et al. (1979) observed that severe defoliation is not always associated with leafspot attack.

Lesions caused by the two pathogens can be visually differentiated. Light brown lesions, with not well-defined borders and usually a halo surrounding the necrotic area, are characteristic of *C. arachidicola*; *C. personatum* induces black round lesions, with more demarcated borders and an absence of a halo. Differentiation of these two lesion types is more pronounced on the lower surface of the leaflets. Differences in lesion shape, color, and the absence or presence of a halo can lead to some confusion (Miller, 1953; Ramakrishna and Apparao, 1968). The production of conidiophores is also used as an external aid to differentiate both species. *C. arachidicola* produces conidiophores with long conidia, mostly on the upper surface of the leaflet; *C. personatum* produces conidia generally on the lower surface, sometimes in clusters arranged concentrically (Woodroof, 1933).

Miller (1953) made a detailed study on the parasitism of the two pathogens. The existence of an unlimited number of biotypes is mentioned. Biotypes of *C. personatum* grew slower than those of *C. arachidicola*, and association of virulence with the type of isolate was observed. No antibiotic action in culture among isolates of the two pathogens or among isolates of the same pathogen was revealed. This would account for the isolation of different biotypes from the same lesion.

Stability among biotypes of *C. arachidicola* was observed by Miller (1953); few mutants were obtained but biotypes differed in pathogenicity and in disease induction. *C. arachidicola* was more pathogenic than *C. personatum*. Genetic variation has also been observed within *C. arachidicola* as a result of the continued use of benomyl fungicide for its control. Thirty-two percent of the lesions collected by Littrell (1974) yielded benomyl-tolerant isolates; differences in the number of colonies per plate and in the degree of tolerance to benomyl were found among tolerant isolates. No morphological changes were observed among isolates, and no influence of the presence of these isolates on defoliation or yield has been observed.

Resistance to infection was studied by Abdou (1966). On moderately susceptible plants, few germ tubes of either pathogen were attracted to open stomata and only one germ tube per stoma penetrated. On immune plants, no attraction of the germ tubes to the stomata was observed. Hemingway (1957) pointed out that penetration takes place only through stomata; however, Jenkins (1938) reports penetration through the lateral walls of the epidermal cells.

Stomatal size was found to affect penetration. Hemingway (1957) observed that most penetrations occurred in stomatal sizes over 16 μ and none in less than 13 μ. The frequency of larger stomata was greater on the susceptible plants than on the resistant ones. Gibbons and Bailey (1966) and Hassan and Beute (1977) found stomatal apertures less than 12 μ in plants highly resistant to Cercospora leafspots. An apparent relationship between width of stomata and reaction to infection was noticed by Abdou et al. (1974). Immunity of young leaves, with immature stomata, was broken after leaf expansion. Hassan and Beute (1977) observed smaller size of stomata in the plants which were placed outside for two weeks than in the plants grown continuously in greenhouse. Weathered plants exhibited increased resistance to leafspots; however, stomatal size was not considered to be the mechanism for the observed increased resistance. Contrarily, McDonald et al. (1979) could not correlate width, length, and frequency of stomata with Cercospora reaction, as well as thickness of the upper epidermis and pallisade tissue, spongy mesophyll and water storage tissue of the lower epidermis. None of the authors reported a relationship between number of stomata and reaction to disease attack.

Reaction of host cells after penetration was investigated by Abdou et al. (1974). Great proliferation of the mycelium and collapse of cells were observed in susceptible plants. *C. arachidicola* seemed to kill the cells in advance of the growing hyphae; whereas no cells were killed in advance with *C. personatum* infection. In resistant plants, the mycelium did not proliferate and a pectin-nature barrier was formed around the site of infection, out of which no mycelium was detected.

Susceptibility in cultivated peanuts has generally been associated with cultivars of Spanish types; early maturity, sequential branching and bunch growth habit. Relative resistance has been found among alternate branching, spreading, late maturing cultivars (Higgins, 1935; Jenkins, 1938; Smartt, 1961; Aulakh et al., 1972; Chahal and Sandhu, 1972; Sowell et al., 1976; Mercer, 1977).

Hemingway (1957) observed more pallisade tissue and darker color leaves in resistant plants. Susceptible plants were light green in color. Susceptibility to leafspots was associated with growth habit of the plant by Chahal and Sandhu (1972). All bunch cultivars, except Tifton 1108, were susceptible. Smartt (1961) noticed that sequentially branched cultivars had light green color and were almost invariably susceptible. The exceptionally resistant cultivar was as dark in color as the alternate types. Likewise, alternate-type susceptible plants had light green color similar to the susceptible Spanish types.

Higgins (1935) attributed leafspot resistance to differences in maturity or productivity rather than to physiological or morphological differences. Resistant lines were generally late maturing and low yielding. Possibilities for producing early maturing types with leafspot resistance were suggested to be remote.

Most of the resistant cultivars tested by Miller (1953) were late maturing, particularly the runner types. He also stated that gynophore removal or damage by the Southern corn rootworm resulted in less leafspot.

More lesions on thirty four day-old plants than on sixty two day-old plants were recorded by Miller (1953). This apparent resistance of old plants was attributed to the fact that most gynophores did not set pods; thus plants were in a highly vegetative stage of growth. No difference in susceptibility with plant age was noticed by Ramakrishna and Apparao (1968). Plants from ten to fifty days old were all equally susceptible.

Root nodulation was also associated with susceptibility. Nodulated plants exhibited less infection, but a greater rate of leaf shedding than non-nodulated plants. In plants grown in soil with high fertility, the presence of nodules did not affect infection by *C. arachidicola*. A negative relationship between riboflavin content of the seed and number of spots per leaflet was also detected (Miller, 1953).

Immunity, or high degree of resistance, has not been found within *hypogaea*. Most of the cultivars tested by Abdou et al. (1974) were susceptible to both pathogens.

Relative resistance to *C. arachidicola* has been reported by Sowell et al. (1976) in PI's 109839, 162857, 350680, 259639, 259679, 259747, 270806, and 269605. Hassan and Beute (1977) observed NC 3033, NC 5, and AC 3139 to be resistant to early leafspot, and Chahal and Sandhu (1972) reported high resistance for Tifton 1108; whereas Aulakh et al. (1972) found Tifton 1108 to be tolerant. Cultivars Tartan, Georgia Red, Valencia, San Jose and Tirik exhibited resistance to *C. personatum* in tests by Reyes and Romasanta (1940). McDonald et al. (1979) selected NC Acc. 17090, EC 76946 and PI 259747 as the most resistant to *C. personatum*. The latter, PI 259747, was also reported by Sowell et al. (1976) to be resistant to *C. arachidicola*.

Several wild species of peanuts have been tested for resistance to *C. arachidicola* and *C. personatum* infection. Gibbons and Bailey (1966) detected no lesions on *A. repens*, *A. glabrata*, and *A. hagenbeckii* under natural infection. *A. correntina* and *A. villosulicarpa* exhibited some lesions and defoliation. Much more defoliation was observed in *A. batizocoi* and *A. rigonii*. The species *A. monticola* was the most susceptible species. Abdou et al. (1974) found immunity to *C. personatum* infection in *A. cardenasii* ; whereas *A. monticola*, *A. duranensis*, and *A. villosa* were susceptible to both pathogens. Most of the species within the section *Erectoides* were susceptible; accessions 10573(b)GKP and 10574 GKP were highly resistant to both diseases and 9795 GKP was moderately resistant. In section *Rhizomatosae*, most of the accessions, including *A. glabrata* displayed high resistance to both leafspots. Accession 10596 GKP was recorded to be immune. Intermediate resistance was found in 10538 GKP of the section *Caulorhizae*.

Abdou et al. (1974) reported *A. villusolicarpa* to be immune to infection by both pathogens; while Gibbons and Bailey (1966) observed lesions and defoliation. Melouk and Banks (1978) found minute lesions on PI 276233 (GK 10596), but Abdou et al. (1974) reported immunity to both diseases. Hypersensitivity is suggested for this type of reaction. They also observed lesions on PI 338280, but no lesions on *A. chacoense*.

Several techniques and methods for disease evaluation have been used in the greenhouse tests. Usually, three week-old seedlings were selected for artificial inoculations and applications of conidia were made using an atomizer (Abdou et al., 1974; Sowell et al., 1976; Hassan and Beute, 1977; Melouk and Banks, 1978). Hassan and Beute (1977) employed concentrations of 5000, 10,000, and 15,000 spores/ml as inoculum. Suspensions of 15,000 spores/ml as inoculum. Suspensions of 15,000 spores/ml were used by Abdou et al. (1974). Melouk and Banks (1978) applied 20,000 spores/ml to detached leaves. Concentrations as high as 50,000 to 100,000 spores/ml were utilized by Sowell et al. (1976). Hemingway (1957), and Sharief et al. (1978) used a camel-hair brush to apply inoculum to both surfaces of the leaflets.

After inoculation the plants were, generally, incubated in a humid chamber for periods varying from 48 hrs. to as much as 8 days.

Temperatures fluctuated between 21° to 32° C and readings were made from 2 to 6 weeks after inoculation (Miller, 1953; Hassan and Beute, 1972; Sowell et al., 1976; Melouk and Banks, 1978; Sharief et al., 1978).

The distal pair of leaflets on the 4th leaf from the apical leaf was scored by Sowell et al. (1976) and leaves below the third terminal were scored by Abdou et al. (1974). Abscissed leaves were also employed by Sharief et al. (1978). Inoculations to detached leaves with their petioles immersed in a nutrient solution were made by Melouk and Banks (1978). McDonald et al. (1979) also used detached leaves for disease assessment.

Number and size of lesions, infected area, sporulation index, and percentage defoliation were used by Abdou et al. (1974) as parameters of disease evaluation in the greenhouse. Number of lesions and abscissed leaves were also used by Sowell et al. (1976); while Hassan and Beute (1977) scored only the number of lesions for assessment of disease.

In the field, Hemingway (1957) removed all leaves with lesions every two days; infection was expected to be just a result of the outcoming inoculum. He brushed the leaves of the plants with inoculum to favor epidemics. All leaves, empty nodes and lesions were counted on fifty plants per cultivar.

Miller (1953) found that during dry weather, high infection can be obtained in the field by spreading culturally grown inoculum or diseased leaves under the plants. Diseased leaves mixed into the first two inches of soil and immediate irrigation gave good results. Even better results were obtained by placing infected leaves on older plants and then watering. It was emphasized that the criteria for disease evaluation depended largely on the circumstances, but lesion counts and percent defoliation were the most useful in differentiating cultivars. Miller points out that lesion counts are useful to the point at which they start to decline, due to new leaf formation and excessive leaf defoliation.

Gibbons and Bailey (1966) exposed potted plants to natural infection, but under artificial conditions of epidemics. Fresh leaves with *C. arachidicola*-lesions were spread on and around the plants to ensure infection. Development of the disease and presence of lesions were recorded but no lesion counts were made. Defoliation was observed at the end of the season but the degree was not quantified. Leaves with spots were also spread around the plants by Aulakh et al. (1972) and artificial inoculations were performed to favor epidemics. Diseased area was estimated on twenty leaves. An increasing 0-5 scale of susceptibility was used for rating resistance. Chahal and Sandhu (1972) employed the same techniques and methods of evaluation as Aulakh et al. (1972).

Soare et al. (1974) tried four methods of disease evaluation: number of lesions on all leaves of the main stem, leaves with lesions, lesions per leaflet and abscissed leaves. Number of lesions per leaf, total number of lesions and number of abscissed leaves were correlated. They concluded that the number of abscissed leaves was the most efficient method for disease evaluation.

The proportion of the length from the base of a limb to the first leaf and the total limb length, number of lesions, leaf area infected, and visual estimations of the percent foliage having lesions were used by Hassan and Beute (1977) to evaluate resistance. Less variation was observed in visual estimation, and defoliation ratio was considered a more reliable assessment of resistance than the number or size of lesions.

Peanut breeding for leafspot resistance started in Georgia in 1931. It included testing of progeny from cultivar crosses. Selections that were very resistant to one pathogen were often extremely susceptible to the other pathogen. An independently inherited resistance to the two leafspots was suggested (Higgins, 1935).

Similar results were obtained by Abdou et al. (1974) working with *Arachis* species in which immunity or a high resistance to one pathogen was accompanied by high susceptibility to the other one. Recessiveness of resistance has been suggested by Smartt (1965). Triploid F_1 hybrids from susceptible x resistant cultivars exhibited no resistance to leafspot diseases.

Populations X_2 and X_3 from irradiated peanuts were studied by Cooper and Gregory (1960). Some increased and some decreased resistance was observed, but no true resistant mutant plant was found. The authors concluded that resistance through mutation breeding was more difficult to induce as the host-pathogen relationship becomes more specific.

According to Hammons (1973), differences in relative resistance to both fungi is due mainly to the fact that scores are made at the same time for early and late maturing cultivars. When disease assessment is made at the same growth stage, such differences disappear and both early and late maturing cultivars are susceptible. Observations made by Mughogho (1969) also support this theory.

Sharief et al. (1978) studied the reaction of *A. chacoense*, *A. carnedasii*, an unnamed *Arachis* species, and their F_1 and F_2 derived hybrids, to infection by both pathogens. After a multiple variate analysis, they concluded that the genetic basis for variation between plants for reaction to both diseases was mostly multifactorial. High broad sense heritabilities (51.8, 93.2, 81.7, and 92.9) were obtained for the disease evaluation parameters, number of lesions/cm^2 diseased area mm^2/cm^2, percentage defoliation and derived disease index, respectively.

A distinctly smaller chromosome pair "A" and a satellited chromosome "B" were detected by Husted (1933, 1936) in *A. hypogaea*. Somatic and meiotic cell observations by Smartt et al. (1978b) resulted in two types of species according to their genome content; species having "A" chromosomes or with genome "A" and species without "A" chromosomes or with genome "B". Two of these species, *A. cardenasii* and *A. duranensis*, were suggested by Gregory and Gregory (1976) to be donor parents of the genomes of *A. hypogaea*; however, Smartt et al. (1978a, 1978b) postulated later, *A. cardenasii* and *A. batizocoi* as possible parents.

The existence of the two genomes in the section *Arachis* is considered important in the use of wild species as genetic sources of resistance to Cercospora leafspots (Smartt et al., 1978b). *A. chacoense* and *A. cardenasii*, resistant to *C. arachidicola* and *C. personatum*, respectively (Abdou et al., 1974), both have "A" genomes; therefore, maximum leafspot resistance might be obtained if resistant factors present in the "A" genome are introgressed into the "B" genomes. Three alternatives are suggested by Smartt et al. (1978b) to introduce factors of resistance into the "A" genome of *hypogaea*: 1) (*A. cardenasii* x *A. chacoense*)-F_2 resistant segregants crossed with *hypogaea*, and induction of hexaploids from the F_1 hybrids and backcrossing to *hypogaea*; 2) Tetraploid production from the (*A. cardenassi x A. chacoense*)-hybrid and crossing with *hypogaea*; and 3) hybridization of the double resistant (*A. cardenassi* x *A. chacoense*)-derivative with *A. batizocoi*, and chromosome doubling of the sterile hybrid, followed by irradiation and selection. The latter alternative is considered to be more feasible.

MATERIALS AND METHODS

Plant Material

Cultigens of *Arachis hypogaea* used in this study of resistance to Cercospora leafspots were obtained from Dr. W. R. Langford, Regional Plant Introduction Station Experiment, GA.; from Dr. R. O. Hammons, ARS, USDA, Tifton, GA.; and from stocks of the Peanut Breeding Project of the University of Florida at Gainesville and Marianna.

During the summer of 1977, one hundred and seventy-eight cultigens, including advanced generations, improved cultivars, and plant introductions, were assessed for Cercospora leafspot diseases.

During the summers of 1978 and 1979, thirty-two cultigens (Ap. Table I) were screened for resistance to early and late leafspot diseases in the field. Twenty-five of these were resistant selections from the 1977 tests, and five were F_6-lines from Dr. D. W. Gorbet of the University of Florida Agricultural Research Center at Marianna. Florigiant and Florunner were included as high yielding cultivars, with susceptibility to the leafspot diseases. The cultigen NC 3033 was discovered not to be pure in the 1978 test and is designated NC 3033-mixture. In 1979, a pure stand of the cultigen NC 3033 replaced the mixed one.

Seven cultigens selected among the most resistant to early and late leafspot diseases during the 1977 and 1978 seasons, and Florunner and Early Bunch were inoculated with spore suspensions of *C. arachidicola* and *C. personatum* in greenhouse tests in 1979 (Ap. Table II).

In the text, for the sake of clarity, all PI's will be designated only by numbers, e.g., PI 196604 will become 196604. A subscript letter following a number as in 306230 a and 306230 b, indicates differences in origin of the seed stocks.

Disease Assessment in Field

The 1977 plant material was planted at the Green Acres Agronomy Farm in Gainesville, FL. One hundred and six cultigens were planted in three replications of one-row plots (3 meters long) and an additional seventy cultigens in non-replicated one-row plots.

Weekly estimations of disease were made beginning 50 days after planting. The leaf canopy was opened up at three places in each plot and the number of lesions in the field view was counted. The average number of lesions in the three places was calculated. At the end of the season, cultigens having one hundred percent defoliation were classified as killed by the disease even though the stems may have still been green. The average number of lesions was coded according to the following scale: 0 = less than 10 lesions, + = 10-20 lesions, ++ = 20-40 lesions, +++ = 40-60 lesions, ++++ = more than 60 lesions, and 5+ = killed plants.

Plants were scored on seven dates. On two dates, at 94 and 116 days after planting, lesions were classified by causal agent: *C. arachidicola* or *C. personatum*. To determine the number of lesions caused by each fungus, ten leaflets were picked from the fourth and fifth leaves down from the apical on stems selected at random from each plot. Lesions were counted on the underside of each leaflet. Lesions caused by *C. arachidicola* were differentiated from those caused by *C. personatum* on the basis of shape and color. Brown lesions with yellow halos were recorded as caused by *C. arachidicola*, while black lesions with defined borders and no halo were recorded as caused by *C. personatum*. A magnifying glass was used to help differentiate between the two types.

In 1978, the material was planted both at Gainesville and Marianna, Florida. Thirty two cultigens were randomly distributed in four replications of two-row plots (3 meters long). Plots of Florunner were planted between two cultigen plots and bordering the entire area as a susceptible control to insure ample inoculum. The plot distribution at Marianna in 1978 is shown in Figure 1. The planting date at Marianna (24 May 1978) was three weeks later than the one at Gainesville (3 May 1978).

At Gainesville, the first observation was made 48 days after planting the second at 71 days, and weekly readings were conducted thereafter to 134 days for a total of eleven assessments. The first observation at Marianna was made 52 days after planting; the second, third, and fourth observations were made at two-week intervals; and weedkly readings taken thereafter to 121 days for a total of eight assessments.

Data on the following variables were recorded on each cultigen at each location: 1) number of lesions caused by *C. arachidicola*, 2) average size of lesions caused by *C. arachidicola*, 3) number of lesions caused by *C. personatum*, 4) average size of lesions caused by *C. personatum*, 5) amount of defoliation, and 6) visual estimations of disease.

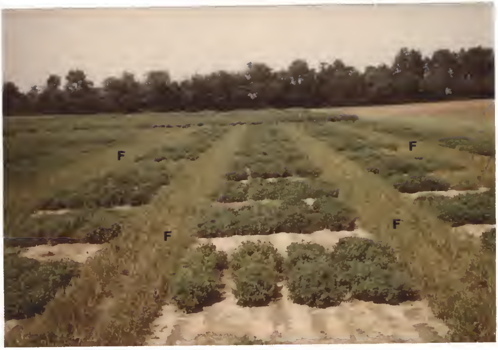

Figure 1. Plot distribution for the assessment of Cercospora leafspot diseases on peanut cultigens at Marianna in 1978. (F = Florunner control).

In 1978, the number of lesions was determined as in 1977 and for each plot the average number of lesions per leaflet caused by each fungus was recorded. Ranking of cultigens on the basis of the number of lesions present was made for each pathogen.

Defoliation was estimated by calculating the number of abscissed leaflets from the total leaves produced in a single stem. One stem per plot was selected at random to estimate the percent of defoliation.

Visual estimates of disease were made by opening the leaf canopy at three sites in each plot and estimating the percentage of leaf area occupied by lesions according to the Horsfall-Barratt conversion table (Horsfall and Barratt, 1945), modified by Berger (unpublished). For each plot, the mean disease of the three sites was recorded and expressed in proportion. These proportions constituted the X values.

The average size of lesions caused by each fungus was determined by measuring the diameter of up to ten lesions per leaflet to the nearest 0.5 mm. Measurements were made three times during the season, at 107, 114, and 120 days after planting.

The general procedure used in 1979 was the same as that used in 1978, except that the number of lesions and average lesion size were recorded for each one of the ten leaflets. Defoliation percentage was estimated on the basis of abscissed leaflets from four stems per plot selected at random. The procedure was repeated at each assessment date throughout the season.

Disease Assessment in Greenhouse

Ten 1978 isolates each of *C. arachidicola* and *C. personatum* originating from Gainesville and Marianna (total of 40 isolates constituted the pathogen population samples in this study.

The isolates were stored on slants of peanut extract agar (PEA) in an incubator at 8° C until needed. A concentrated conidial suspension of each isolate was prepared by adding 1.0 ml of sterilized water to the slants. Inoculum was prepared by pipetting 0.5 ml from the concentrated spore suspension to potato dextrose agar (PDA) plates, and incubating the plates with *C. personatum* for two weeks and those with *C. arachidicola* for one week with 12 hrs-23° C dark periods and 12 hrs-27° C light periods.

Spores of each isolate were harvested after adding 7 ml of sterilized water to each plate, and rubbing the surface of the culture with a glass rod. The ten isolates comprising a population sample were mixed in equal proportions of 20000 spores/ml. One drop of Tween 80 was added per 100 ml of suspension to break the surface tension between leaf and water droplets.

Four three-week-old plants growing in one pot were inoculated. An atomizer with 10 p.s.i. pressure was used for application of the suspensions. Inoculum was applied to both surfaces of the leaves until a film of water was observed on them. Inoculated plants were incubated for 48 hrs in a polyethylene humidity chamber constructed under the greenhouse bench. High humidity in the chamber was maintained by watering the soil and wetting pieces of cheesecloth hung on the walls of the chambers. After incubation, plants were transferred to the greenhouse bench until disease assessments were made.

Two factors were considered in the experiment: *C. arachidicola* (A), and *C. personatum* (P). The source of the pathogen constituted the levels within each factor. The treatment combinations were prepared just before application. Equal amounts of spore suspensions of the two population samples were mixed to obtain a total of 20000 spores/ml. Inoculations made at different dates (eight) were considered eight replications. Assessments were made for number of lesions and defoliation. Leaflets between the third to fifth level that exhibited the highest number of lesions were selected for lesion counts. One leaflet per plant was scored. *C. arachidicola*-lesions were recorded two weeks after inoculation and *C. personatum*-lesions three weeks after inoculation. Defoliation percentage was scored for *C. arachidicola* three weeks after inoculation and four weeks after for *C. personatum*.

In field tests, visual estimates of disease (X values) and defoliation (D) were used to calculate the total disease (X_T values) for each cultigen and for each date according to the formula $X_T = (1-D)X + D$ (Plaut and Berger, 1980); where X is the proportion of the estimated disease and D the proportion of defoliation. Disease progress monitored in this way allowed calculation of the apparent infection rate (r value), between two defined dates, according to the formula by Vanderplank (1963): $r = (\text{logit } X_2 - \text{logit } X_1)/t$; where logit X_1 is equal to $\ln[X/(1=X)]$ for one date and logit X_2 equals to $\ln[X/(1=X)]$ at the next observation (ln = natural logarithm). The t value is the period (in days) between two observation dates. The r values thus calculated are the slopes of the transformed disease progress curves during period t. Graphs of logit values plotted against time were drawn contrasting the disease progress curves for the cultigens with that for the control Florunner. The area under disease progress curve (AUDPC) was calculated according to the following: AUDPC = $(0.5\ X_0 + X_1 + X_2 + \ldots + 0.5\ X_t)\ t$; where X_0, X_1, $X_2, \ldots, X_t$ are the X_T values and t the lapse between observation dates (James, 1974). The critical point model (James, 1974) also was used to differentiate the relative resistance of the cultigens. It is derived from disease progress curves, and is considered the time when $X_T = 0.5$.

Analysis of Variance

In 1978, a completely balanced mixed model was used with cross classified and nested effects as follows:

$$Y_{ijkl} = U + G_i + D_j + R(L)_{k(l)} + L_l + GL_{il} + GD_{ij} + GR(L)_{ik(l)} + DL_{jl} + DR(L)_{jk(l)} + GDL_{ijl} + GDR(L)_{ijk(l)}$$

where

U = overall mean,

G_i = random effect of the ith cultigen (genotype),

D_j = fixed effect of the jth date,

$R(L)_{k(l)}$ = random effect of the kth replication in the lth location,

L_l = fixed effect of the lth location,

$i = 1, \ldots, 32$ cultigens (genotypes),

$j = 1, \ldots, 7$ dates,

$k = 1, \ldots, 8$ replications, and

$l = 1, \ldots, 2$ locations.

The remaining terms are the corresponding interactions.

For the 1978 and 1979 analyses the date of assessment was based on the age of the plant. Readings were taken in each location at the approximate plant age as follows:

	Dates of Assessments						
Locations	1	2	3	4	5	6	7
---------	-------- Days after planting -------------------						
Gainesville	48	78	92	99	106	113	120
Marianna	52	80	94	100	107	114	121

Tests of significance for random effects were performed utilizing the appropriate error terms. For fixed effects, error terms were synthesized to form a linear combination of mean squares. The degrees of freedom associated with the linear combinations have been estimated using the approach of Satterthwaite (Satterthwaite, 1946; Cochran, 1951).

Six independent variables were considered in the analysis: Y_1 = number of lesions caused by *C. arachidicola*, Y_2 = size of lesions caused by *C. arachidicola*, Y_3 = number of lesions caused by *C. personatum*, Y_4 = size of lesions caused by *C. personatum*, Y_5 = amount of defoliation caused by the complex, and Y_6 = visual estimates of disease. Additionally, four dependent variables were also analyzed: $Y_7 = (Y_1)(Y_2)(Y_2)$, representing the diseased area caused by *C. arachidicola*, $Y_8 = (Y_3)(Y_4)(Y_4)$, representing the diseased area caused by *C. personatum*, $Y_9 = Y_7 + Y_8$, representing the diseased area caused by both pathogens, and $Y_{10} = [1-Y_5/100]\ (Y_6/100) + Y_5/100$, representing total disease (X_T values).

The same balanced mixed model was used in 1979 as in 1978. In addition, repeated measurements were analyzed for number of lesions (Y_1,Y_3), for size of lesions (Y_2,Y_4), and for percent defoliation (Y_5). Only means were analyzed for visual estimates of disease (Y_6). Tests of significance were obtained as in 1978.

The combined data from 1978 and 1979 were analyzed to detect any existing season (year) interaction. The model for this analysis included the following effects:

$$\begin{aligned} Y_{ijklm} = {} & U + G_i + D_j + R(L,S)_{k(l,m)} + L_l + S_m + GD_{ij} + \\ & GR(L,S)_{ik(l,m)} + GL_{il} + GS_{im} + DR(L,S)_{jk(l,m)} + DL_{jl} + \\ & DS_{jk} + LS_{lm} + GDR(L,S)_{ijk(l,m)} + GDL_{ijl} + GDS_{ilm} + \\ & DLS_{jlm} + GDLS_{ijlm} + GLS_{ilm} \end{aligned}$$

where

S_m = random effect of the mth season (year),

$R(L,S)_{k(l,m)}$ = random effect of the kth replication in the lth location and in the mth season,

$m = 1,\ldots,$ 2 seasons, and

$k = 1,\ldots,$ 16 replications.

The remaining terms are the same as indicated for the 1978 analysis, and the corresponding higher order interactions. Appropriate error terms were used for the corresponding tests of significance. The degrees of freedom associated with the linear combinations of mean squares were estimated as explained above. Duncan's multiple range tests were used to compare treatment means.

Since the disease was most severe near the end of the growing season only mean differences from the last day of assessment were tested for significance.

Variance estimates were obtained by equating the mean square values of the different sources of variation to their components of variance plus the appropriate error term; so that the latter was subtracted and the value thus obtained divided by the corresponding k values (k = value associated with the variance component) (Crump, 1946).

Variation due to cultigens constituted the genetic variance. The remaining variances were those due to genotype-environment interaction components and to experimental error. Appropriate fractions of the various genotype-environment interaction components and the error variance were included in the estimate of the phenotypic variance would be:

$$\sigma_p^2 = \sigma_g^2 + \frac{\sigma^2 gl}{L} + \frac{\sigma^2 gr(l)}{R(L)} + \frac{\sigma^2 gd}{D} + \frac{\sigma^2 gdl}{DL} + \frac{\sigma^2 gdr(l)}{DR(L)} + \frac{\sigma^2 e}{N}$$

and the phenotypic variance for two years would be:

$$\sigma_p^2 = \sigma_g^2 + \frac{\sigma^2 gs}{S} + \frac{\sigma^2 gl}{L} + \frac{\sigma^2 gls}{LS} + \frac{\sigma^2 gr(l,s)}{R(L,S)} + \frac{\sigma^2 gd}{D} + \frac{\sigma^2 gls}{LS} +$$

$$\frac{\sigma^2 gdl}{DL} + \frac{\sigma^2 gdl}{DLS} + \frac{\sigma^2 gdr(l,s)}{DR(L,S)}$$

where σ_g^2 = genetic component for cultigens,

$\sigma^2 gd$ =genotype-date interaction component,

$\sigma^2 gr(l,s)$ = genotype-replication interaction component,

$\sigma^2 gl$ = genotype-location interaction component,

$\sigma^2 gs$ = genotype-season interaction component,

$\sigma^2 gdr(l,s)$ = genotype-date-replication interaction component,

σ^2gdl = genotype-date-location interaction component,

σ^2gds = genotype-date=season interaction component

σ^2gls = genotype-location=season interaction component,

σ^2gdls = genotype-date-location-season interaction component,

σ^2_e = error component (only in 1979 for Y_1 to Y_5) ,

and D, R(L), R(L,S), L, S, and N represent number of dates, replications in locations, replications in locations and seasons, locations seasons, and number of measurements, respectively.

Estimation of covariances were made in the same way as of variances, but using mean products instead of mean squares. Covariation due to cultigens constituted the genetic covariance and the phenotypic covariance included all the genotype-environment covariance components divided by appropriate numbers.

Confidence intervals for genetic variances were computed to test H_0: ≠ 0. As no assumptions could be made about the distribution of the estimated variances and the exact number of degrees of freedom was unknown, only an approximation of the X^2 (chi square) distribution could be made. Estimated degrees of freedom were calculated for the genetic variances according to the Satterthwaite approach (Satterthwaite, 1946).

The degree of genetic correlation between two variables, or the extent to which they are influenced by the same set of genes, was calculated as the ratio of the genetic covariance of a pair of variables to the product of the two genetic standard deviations. The direct association of a pair of variables was ascribed to the correlation of the observed values; i.e., to the phenotypic correlation.

Broad sense heritability for number of lesions for the 1978 and 1979 combined seasons was calculated as the proportion of the total genetic variance and the phenotypic variance, which included the genotypic component, the genotypic interaction components and the error components as follows:

$$h^2 = \frac{\sigma^2 g}{\sigma^2 g + \frac{\sigma^2 gd}{D} + \frac{\sigma^2 gr(l,s)}{R(L,S)} + \frac{\sigma^2 gl}{L} + \frac{\sigma^2 gs}{S} + \frac{\sigma^2 gdr(l,s)}{DR(L,S)} + \frac{\sigma^2 gdl}{DL} + \frac{\sigma^2 gds}{DS} + \frac{\sigma^2 gls}{LS} + \frac{\sigma^2 gdls}{DLS}}$$

Greenhouse Tests

The following three classes of variation were considered in the greenhouse tests: a) sources of inoculum (I_1 = *C. arachidicola,* I_2 = *C. personatum*, and I_3 = *C. arachidicola* plus *C. personatum),* b) locations (L_1 = Gainesville and L_2 = Marianna), and c) cultigens (261906, 162539, 261893 a, 203397, 306230 b, 196604, 196660, Early Bunch, and Florunner). Three variables, number of lesions caused by *C. arachidicola,* number of lesions caused by *C. personatum*, and percent defoliation were analyzed according to the model

$$Y_{ijkl} = U + L_i + I_j + G_k + IG_{jk} + e_{ijkl}$$

where

U = overall mean,

L_i = random effect of the ith location,

I_j = fixed effect of the jth source of inoculum,

G_k = fixed effect of the kth cultigen,

IG_{jk} = joint effect of the jth source of inoculum and the kth cultigen, and

e_{ijkl} = error term which includes all other interactions. The experiment included three replications. Duncan's multiple range test was used for testing significance.

EXPERIMENTAL RESULTS

Disease Incidence

Eighty percent of the cultigens tested in 1977 were judged '++++' and '5+' or very susceptible to Cercospora leafspots while twenty percent showed varying degrees of resistance to the pathogens. Cultigens 196604, 196652, 196666, 196673, 306222, 306230 a, 306230 b, NC 3033, 196677, 109839 a, 109839 b, and 300947 exhibited resistance to leafspot caused by *C. arachidicola*; while cultigens 196658, 203397, 203395, 261893 a, 261893 b, 261906, 3525-F_2, and FESR-5 exhibited resistance to leafspot caused by *C. personatum*.

The average X_T values (visual disease estimates plus defoliation) calculated for 1978 are presented in Appendix Tables III and IV. X_T values for 1979 are listed in Appendix Tables V and VI and those for the combined 1978 and 1979 seasons are given in Appendix Table VII.

In Fig. 2 are shown the differences in resistance to Cercospora leafspots displayed by the peanut cultigens screened at Marianna in 1979. In Figs. 3 and 4 are shown the amount of Cercospora leafspots and defoliation exhibited by the cultigen 306230 b and the susceptible control Florunner, respectively.

The logarithmically transformed disease progress curves are shown in Figs. 5 to 8. Disease progress curves of two resistant cultigens are presented in each figure, contrasting them with the curve for Florunner. At Gainesville there was a 10 to 17-day delay, by the less susceptible cultigens, in the time needed to reach $X_T = .5$, and in Marianna 8 to 13 days.

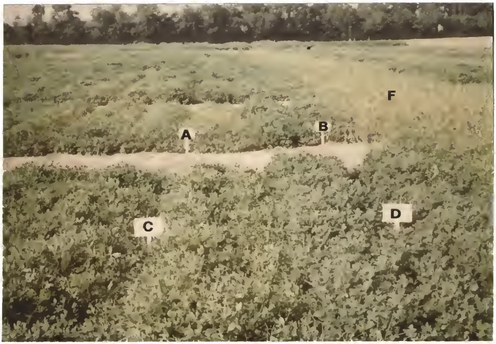

Figure 2. Differences in resistance to Cercospora leafspots displayed by peanut cultigens at Marianna in 1979. (A = 3525-F, B = 203396, C = FESR-5, D = 196604, and F = Florunner control).

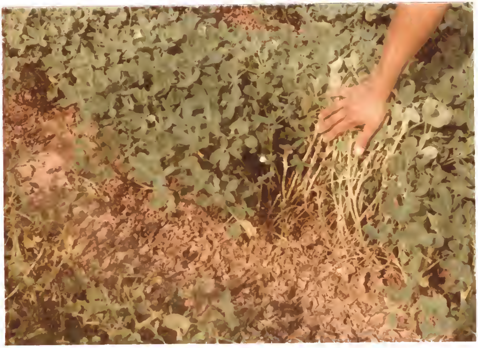

Figure 3. Cercospora leafspots and amount of defoliation displayed by the resistant cultigen 306230 b 107 days after planting at Marianna in 1979.

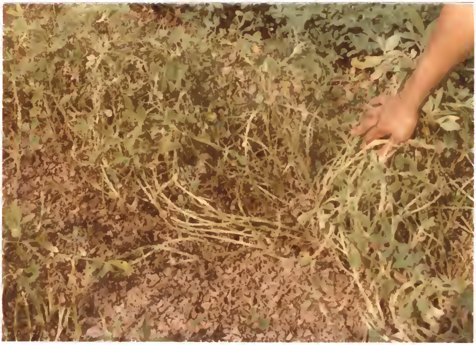

Figure 4. Cercospora leafspots and amount of defoliation displayed by the susceptible cultigen Florunner 107 days after planting at Marianna in 1979.

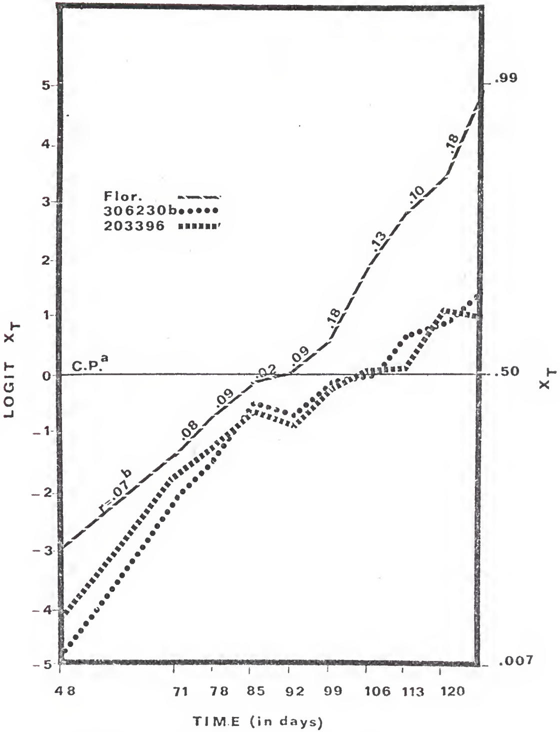

Figure 5. Logarithmically transformed disease progress curves for Cercospora leafspots in the resistant cultigens 306230 b and 203396, and the susceptible control, Florunner, at Gainesville in 1978.

[a] C.P. = Critical point

[b] r = Apparent infection rate values for the disease progress curve of Florunner.

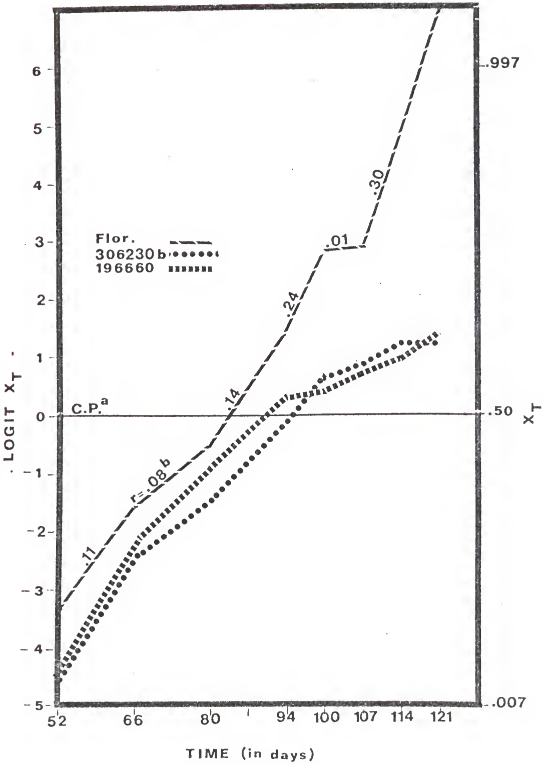

Figure 6. Logarithmically transformed disease progress curves for Cercospora leafspots in the resistant cultigens 306230 b and 196660, and the susceptible control, Florunner, at Marianna in 1978.

[a] C.P. = Critical point

[b] r = Apparent infection rate values for the disease progress curve of Florunner.

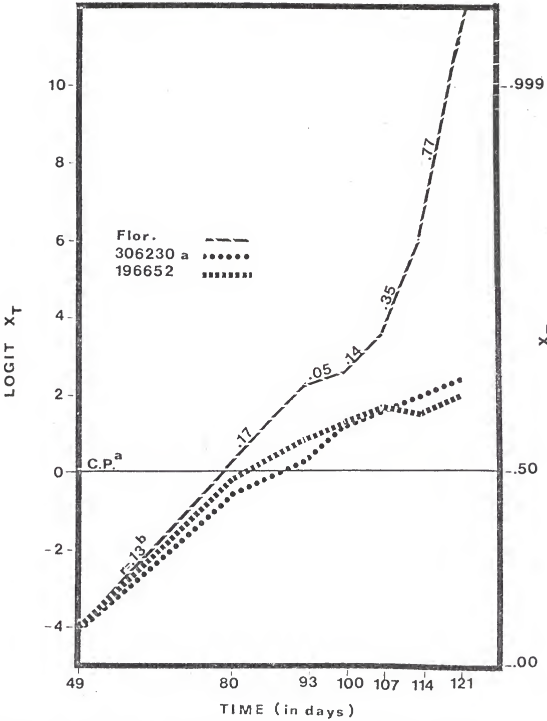

Figure 7. Logarithmically transformed disease progress curves for Cercospora leafspots in the *C. arachidicola*-resistant cultigens 306230 and 196652, and the susceptible control, Florunner, at Gainesville in 1979.

[a] C.P. = Critical point

[b] r = Apparent infection rate values for the disease progress curve of Florunner.

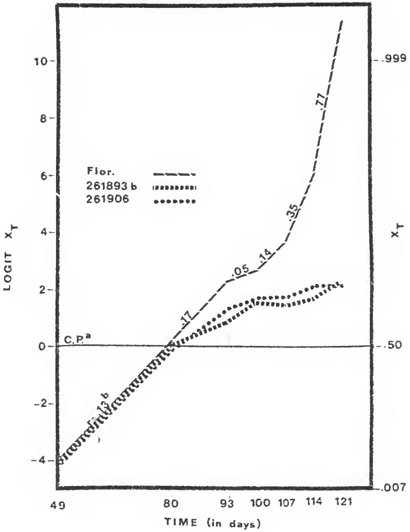

Figure 8. Logarithmically transformed disease progress curves for Cercospora leafspots in the *C. personatum*-resistant cultigens 261893 b and 261906, and the susceptible control, Florunner, at Gainesville in 1979.

[a] C.P. = Critical point.

[b] r = Apparent infection rate values for the disease progress curve of Florunner.

As most of the disease progress curves show similar patterns, the area under disease progress curve (AUDPC) was calculated only for cultigen 306230 b, resistant in both locations to total disease, to illustrate the reduction in diseased area by the resistant cultigens. Cultigen 306230 b had a reduction of 13.0 and 14.1 units of diseased area at Gainesville and Marianna, respectively, in relation to the diseased area in Florunner.

The average numbers of *C. arachidicola*-lesions per leaflet are presented in Ap. Tables VII and IX for 1978, in X and XI for 1979, and in XII for the combined 1978 and 1979 seasons.

The average numbers of *C. personatum*-lesions exhibited by the cultigens in 1978 are listed in Ap. Tables XII and XIV. Those exhibited in 1979 are presented in Ap. Tables XV and XVI, and those averaged over locations and seasons are shown in Ap. Table XVII.

The average sizes of *C. arachidicola*-lesions (Ø in mm) are presented in Ap. Tables SVIII and XIX for the two locations in 1979. In Ap. Tables XX and XXI the average sizes of *C. personatum*-lesions are listed for both locations in 1979.

The percent defoliation induced by the complex *C. arachidicola*-*C. personatum* on cultigens in 1979 is presented in Ap. Tables XXII and XXIII for both locations.

Analyses of Variance

The mean squares and F values for number of size of *C. arachidicola*-lesions, percent defoliation, and visual disease estimates exhibited by the peanut cultigens in 1978, 1979, and the combined 1978 and 1979 seasons are presented in Tables 1, 2, and 3, respectively. The location means for number and size of lesions, percent defoliation, and total disease (visual disease estimates plus defoliation) at the last (seventh) date of assessment in 1978 and in 1979, are presented in Table 4.

Table 1. Mean squares and F values for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and visual disease estimates for peanut cultigens in 1978.

		C. arac. No. lesions		*C. arac.* size les.		*C. per.* No. lesions	
Source	d.f.	MS	F	MS	F	MS	F
L	1	617.34	22.80**	58.36	.63	22.61	.88
G	31	123.95	37.00**	6.29	3.91 **	60.20	15.97**
GL	31	3.33	.99	2.76	1.71*	6.46	1.71*
GR(L)	186	3.35	1.55**	1.61	53.67**	3.77	2.51**
D	6	562.36	50.25**	.39	3.9	289.49	27.60**
GD	186	7.65	3.54**	.05	1.67**	8.56	5.71**
GDL	186	2.89	1.34**	.05	1.67**	1.45	0.97
GDR(L)	1116	2.16		.05		1.50	

		C. per. No. lesions		Percent defoliation		Visual disease estimates	
L	1	.75	.20	87584.14	143.67**	16146.00	7.45*
G	31	8.76	7.82**	1243.28	18.58**	7506.10	87.02**
GL	31	2.47	2.20**	72.80	1.09	209.95	2.43**
GR(L)	186	1.12	28.00**	66.91	2.06**	86.26	2.16**
D	6	1.20	7.50**	161336.04	541.16**	53001.19	97.53**
GD	186	.03	.75**	120.35	3.71**	366.59	9.18**
GDL	186	.04	1.00	48.70	1.50**	69.08	1.73**
GDR(L)	1116	.04		32.41		39.94	

* P = .05 **P = .01

Table 2. Mean squares and F values for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and visual disease estimates for peanut cultigens in 1979.

		C. arac. No. lesions		*C. arac.* size lesions		*C. per.* No. lesions	
Source	d.f.	MS	F	MS	F	MS	F
L	1	5975.28	9.76*	18.77	.67	25064.98	18.46**
G	31	2308.94	52.36**	41.83	24.32**	12145.19	62.89**
GL	31	194.12	4.40**	6.94	4.03**	580.68	3.01**
GR(L)	186	44.10	1.72	1.72	1.47	193.12	1.87
GD	186	123.42	4.81**	2.93	2.50**	956.68	9.27**
GDL	186	89.64	3.50**	2.39	2.04**	439.95	4.26**
GDR(L)	1116	25.62	2.28**	1.17	1.58**	103.21	2.68**
Error	16128	11.26		.74		38.38	

		C. pers. size lesions		Percent defoliation		Visual disease estimates	
L	1	239.97	74.99**	3472.43	4.52**	6524.72	4.15
G	31	53.33	72.80**	818.81	11.19**	5207.31	83.41**
GL	31	2.33	3.06**	203.94	2.79**	395.52	6.33**
GR(L)	186	.76	1.43	73.15	1.29**	62.43	1.62
GD	186	3.14	5.92**	125.90	2.23**	340.34	8.84**
GDL	186	1.76	3.32**	86.11	1.52**	107.55	2.79**
GDR(L)	1116	.53	2.21**	56.47	1.30**	38.50	---
Error	(a)	.24		43.35		---	

(a) For *C. personatum*-lesion size d.f. = 16128, for percent defoliation d.f. = 5376, for visual disease estimates d.f. = 0.

* P = .05   ** P = .01.

Table 3. Mean squares and F values for number and size of *C. arachidicola* and *C. personatum*-lesions percent defoliation, and visual disease estimates for peanut cultigens in the combined 1978 and 1979 seasons.

		C. arac. No. lesions		*C. arac.* size lesions		*C. pers.* No. lesions	
Source	d.f.	MS	F	MS	F	MS	F
G	31	367.14	5.47**	10.50	5.19**	1274.78	1.94*
GS	31	67.11	5.13**	2.04	1.66*	656.14	24.68**
GL	31	39.32	1.66	2.98	2.40*	99.50	1.16
GLS	31	23.71	1.81**	1.24	1.01	85.83	3.23**
GR(L,S)	372	13.09	1.11	1.23	2.73**	26.59	1.04**
GD	186	27.15	1.74**	.44	.94	123.18	1.71**
GDS	186	15.60	1.33**	.47	1.04	72.13	2.81**
GDL	186	17.82	.89	.60	1.09	51.67	.93
GDLS	186	20.04	1.71**	.55	1.22*	55.28	2.16**
GDR(L,S)	2232	11.73		.45		25.63	

		C. pers. size lesions		Percent defoliation		Visual disease estimates	
Source	d.f.	MS	F	MS	F	MS	F
G	31	14.33	14.18**	1050.48	2.70**	11969.81	16.34**
GS	31	1.01	1.33	388.69	6.67**	732.67	10.16**
GL	31	1.55	.81	73.49	.77	266.97	.75
GLS	31	1.91	2.51**	95.46	1.64*	357.79	4.96**
GR(L,S)	372	.76	4.00**	58.27	1.39	72.11	1.83**
GD	186	.33	1.03	130.33	1.95**	632.67	7.48**
GDS	186	.32	1.68**	66.89	1.60**	84.54	2.15**
GDL	186	.28	.96	53.17	.95	88.55	1.04
GDLS	186	.29	1.53	55.86	1.34**	85.24	2.16**
GDR(L,S)	2232	.19		41.81		39.37	

* P = .05   ** P = .01

Table 4. Location means for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and total disease (visual disease estimates plus defoliation) for peanut cultigens at the last date of assessment in 1978 and 1979 at Gainesville and Marianna.

	Gainesville (L_1)	Marianna (L_2)	L_2-L_1
C. arach.-lesion number, 1978	3.79	4.54	.75 NS
C. arach.-lesion number, 1979	5.67	3.93	1.74 NS
C. perso.-lesion number, 1978	2.31	3.34	1.03 NS
C. perso.-lesion number, 1979	9.68	10.32	-.64 NS
C. arach.-lesion size, 1979	1.42	1.11	.32 NS
C. perso.-lesion size, 1979	.50	.90	-.40 **
Percent defoliation, 1979	.84	.83	.01 NS
Total disease, 1978	.79	.83	.04 NS

** P = .01 NS = No significant difference.

In Table 5, the date means for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and total disease (visual disease estimates plus defoliation), averaged over locations, are given for 1978 and 1979.

The cultigen means for number of *C. arachidicola*- and *C. personatum*-lesions over locations, for 1978 and 1979 are presented in Tables 6 and 7, respectively.

In Table 8 the cultigen means for size of *C. arachidicola*- and *C. personatum*-lesions are listed for 1979 averaged over locations.

The cultigen means for total disease (visual disease estimates plus defoliation) for 1978, and for percent defoliation, averaged over locations, for 1979 are shown in Table 9.

The cultigen means averaged over locations and seasons for number of *C. arachidicola*- and *C. personatum*-lesions are presented in Table 10.

The differences in response of a cultigen to location for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and total disease (visual disease estimates plus defoliation), or the genotype-location (GL) interaction within a season, are listed in Tables 11 and 12 for 1978 and 1979, respectively.

The differences in response of a cultigen to season for number of *C. arachidicola*- and *C. personatum*-lesion, or the genotype-season (GS) interaction averaged over locations, are presented in Table 13 for the combined 1978 and 1979 seasons.

The cultigen mean season differences for number of *C. arachidicola* and *C. personatum*-lesions, or the genotype-season (GS) interaction within location for the combined 1978 and 1979 seasons are listed in Table 14.

Table 5. Date means for number and size (Ø in mm) of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and total disease (visual estimates plus defoliation) over locations for peanut cultigens in 1978 and 1979 at Gainesville and Marianna.

	Lesions number		Total disease	Lesions number		Lesions size		Defoliation
Dates	*C. a.*	*C. p.*	X_T	*C. a.*	*C. p.*	*C. a.*	*C. p.*	%
1	.38	.00 a	.02	.25	.00 a	.50	.00	.05
2	1.52	.11 a	.27	3.06a	1.78 a	1.70	.75 a	47.52
3	2.72 a(1)	.39 ab	.52	3.38 a	7.20 b	1.45	1.20	59.23
4	3.11 ac	.86 bc	.61	4.42 b	7.09 b	1.35 a	.50 b	70.69
5	3.64 bc	1.40 c	.65	4.20 b	9.30 c	1.15	.50 b	76.57
6	4.57 d	2.29 d	.77	4.84 b	9.84 c	1.30 a	.85 a	82.62
7	4.16	2.82 d	.81	4.80 b	9.95 c	1.30 a	.75 a	83.22

(1) Any two means with the same letter are not significantly different at level P = .05 (Duncan's multiple range test).
C. a. = *C. arachidicola*; *C. p.* = *C. personatum*; and X_T = visual disease estimates plus defoliation.

Table 6. Multiple range tests for number of *C. arachidicola*-lesions over locations for peanut cultigens at the last date of assessment in 1978 and 1979.

1978		1979	
Cultigen	Mean	Cultigen	Mean
306230 b	1.40	306230 b	1.43
306230	1.73	109839 b	1.66
F_6 306230	1.84	306230 a	1.95
196604	1.86	196652	2.07
121067 x F	2.43	109839 a	2.10
109839 b	2.46	196604	2.12
109839 a	2.56	196666	2.17
NC 3033	2.79	121067 x F	2.31
196652	2.96	196677	2.38
F x 121067	3.02	F_6 306230	2.55
196677	3.14	306222	2.55
306222	3.26	NC 3033	2.93
300947	3.32	300947	3.37
196660	3.33	F x 121067	3.71
261893 c	3.51	196673	3.91
196666	3.68	196660	3.96
261893 b	3.70	F_6-203396	4.58
203396	3.76	261893 c	4.88
F_6-439	4.01	261893 a	5.01
261893 a	4.12	F_6-439	5.87
F_6 203396	4.31	262090	5.89
196658	4.48	261893 b	6.08
203395	4.62	203397	6.38
203397	4.68	196658	6.41
162539	4.92	203395	6.74
196673	5.13	203396	6.83
261906	5.29	Florunner	6.90
262090	5.56	162539	7.52
3525-F	7.61	261906	7.62
Florunner	7.77	3525-F	8.91
FESR-5	8.57	Florigiant	10.80
Florigiant	11.42	FESR-5	11.83

Any two means included in the same vertical line are not significantly different at level P = .05 (Duncan's multiple range test).

Table 7. Multiple range tests for number of *C. personatum*-lesions over locations for peanut cultigens at the last date of assessment in 1978 and 1979.

1978		1979	
Cultigen	Mean	Cultigen	Mean
261893 a	.00	261893 b	.47
261893 b	.00	261906	.52
261893 c	.00	FESR-5	1.02
FESR-5	.00	261893 a	1.05
196658	.08	261893 c	1.18
203397	.08	262090	2.16
262090	.12	203396	3.07
261906	.30	196659	3.25
3525-F	.37	203397	3.36
203395	.49	162539	3.72
162539	.51	Florigiant	3.85
Florigiant	.92	F_6-203396	4.03
203396	1.02	3525-F	5.23
F_6-439	1.27	203395	6.67
F_6 203396	1.60	F_6-439	6.67
196673	2.53	Florunner	7.19
Florunner	2.74	306230 b	12.11
196660	2.85	196660	12.81
121067 x F	3.88	109839 b	13.28
196604	4.06	109839 a	13.76
109839 a	4.39	F x 121067	13.85
F x 121067	4.40	306230 a	13.98
306230 a	4.41	196652	14.18
306230 b	4.43	196673	14.71
196666	4.53	306233	16.11
196677	4.82	121067 x F	16.80
196652	5.15	F_6-306230	16.92
109839 b	5.17	196677	17.53
300947	5.50	300947	17.60
306222	6.28	196604	17.90
F_6 306230	7.57	196666	18.37
NC 3033	10.73	NC 3033	30.22

Any two means included in the same vertical line are not significantly different at level P = .05 (Duncan's multiple range test).

Table 8. Multiple range tests for size (Ø in mm) of *C. arachidicola-* and *C. personatum*-lesions over locations for peanut cultigens at the last date of assessment in 1979.

--- *C. arachidicola* ---		---- *C. personatum* ----	
Cultigen	Mean	Cultigen	Mean
306230 a	.75	261893 b	.25
306230 b	.75	261906	.25
196604	.75	261893 a	.25
109839 a	.85	FESR-5	.50
196652	1.00	261893 c	.50
196666	1.00	262090	.50
121067 x F	1.00	203396	.50
306222	1.00	196658	.50
109839 b	1.00	203397	.60
NC 3033	1.00	203395	.60
F_6-306230	1.10	162539	.60
300947	1.10	Florigiant	.75
196677	1.20	$F_6$203396	.75
F x 121067	1.20	F_6-439	.75
196660	1.25	3525-F	.75
F_6-439	1.25	196604	.75
$F_6$203396	1.30	196660	.75
203396	1.30	196652	.75
196658	1.30	Florunner	.79
162539	1.35	306230 a	.85
203397	1.35	300947	.85
203395	1.40	196673	.85
262090	1.45	109839 b	.85
Florunner	1.45	F x 121067	.95
261906	1.50	306222	.95
261893 c	1.55	196666	.95
196673	1.60	109839 a	1.00
261893 a	1.65	196677	1.00
Florigiant	1.75	121067	1.00
261893 b	1.75	$F_6$306230	1.10
FESR-5	1.85	306230 b	1.10
3525-F	2.25	NC 3033	1.25

Any two means included in the same vertical line are not significantly different at level P = .05 (Duncan's multiple range test).

Table 9. Multiple range tests for total disease (visual disease estimates plus defoliation) and percent defoliation over locations for peanut cultigens at the last date of assessment in 1978 and 1979, respectively.

Total disease (1978)		Percent defoliation (1979)	
Cultigen	Mean	Cultigen	Mean
306230 b	.73	203397	78.0
196673	.74	196658	78.1
196658	.74	306230 a	80.0
293395	.74	306230 b	80.5
300947	.74	F_6-203396	80.5
109839 a	.75	196660	80.6
109839 b	.75	203396	80.6
203397	.76	109839 a	81.6
196604	.76	NC 3033	81.8
306230 a	.76	261893 b	81.9
196660	.76	196673	82.1
F_6-439	.76	203395	82.1
203396	.77	196677	82.3
262090	.77	196666	82.4
F_6-203396	.77	109839 b	82.4
162539	.78	196652	82.7
196677	.78	261893 a	82.7
196666	.78	196604	82.8
196652	.79	F_6-439	83.0
F x 121067	.79	162539	83.1
261893 b	.80	300947	83.1
261893 c	.80	262090	83.2
261906	.82	261906	83.4
261893 a	.83	261893 c	83.4
306222	.85	121067 x F	84.5
NC 3033	.85	F_6-306230	85.0
F_6 306230	.85	30622	85.9
121067 x F	.88	3525-F	86.5
3525-F	.93	FESR-5	86.8
FESR-5	.97	F x 121067	86.9
Florunner	.98	Florigiant	92.7
Florigiant	.98	Florunner	94.8

Any two means included in the same vertical line are not significantly different at level P = .05 (Duncan's multiple range test).

Table 10. Multiple range tests for number of *C. arachidicola*-*C. personatum*-lesions over locations and seasons for peanut cultigens at the last date of assessment in the combined 1978 and 1979 seasons.

---- *C. arachidicola* ----		----- *C. personatum* -----	
Cultigen	Mean	Cultigen	Mean
109839 b	1.73	261893 a	.00
306230	1.76	261893 b	.00
196604	2.30	FESR-5	.00
121067 x F	2.40	261906	.15
F_6-306230	2.46	261893 c	.75
306230 a	2.74	262090	1.18
196677	2.75	Florigiant	1.46
109839 a	2.90	3525-F	1.87
196666	3.02	162539	2.25
300947	3.03	196658	2.35
F x 121067	3.07	203397	2.47
196652	3.23	203395	2.68
306222	3.38	F_6-203396	3.23
NC 3033	3.70	203396	4.26
F_6-203396	4.28	Florunner	5.37
F_6-439	4.31	196660	7.05
196660	4.72	306230 b	7.65
196658	4.86	F_6-439	8.01
196673	4.94	F x 121067	9.32
261893 a	5.24	109839 a	9.94
203395	5.69	196677	10.41
203397	5.71	121067 x F	11.44
261893 c	5.75	196604	11.71
261893 b	6.16	109839 b	11.77
203396	6.19	19666	12.01
262090	6.53	306222	12.01
Florunner	7.44	196652	12.81
162539	7.58	F_6-306230	13.59
3525-F	9.30	306230 a	14.01
261906	9.64	300947	14.25
Florigiant	10.58	196673	23.40
FESR-5	10.59	NC 3033	23.86

Any two means included in the same vertical line are not significantly different at level P = .05 (Duncan's multiple range test).

Table 11. Genotype-location interactions for number of *C. arachidicola*- and *C. personatum*-lesions and total disease (visual disease estimates plus defoliation) for peanut cultigens at the last date of assessment in 1978.

Cultigen	*C. arachidicola*	*C. personatum*	Total disease
	(L_1 - L_2)	(L_1 - L_2)	(L_1 - L_2)
196604	.18	2.48	.01
196652	-2.82*	2.80*	.06
196666	4.30**	2.67	-.01
196673	-1.33	.87	.08
306222	-1.72	-3.63*	-.06
306230 a	.33	2.02	.09
306230 b	-.30	-.27	.08
NC 3033	-1.35	1.27	-.03
FESR-5	-2.85*	.00	.04
196658	1.37	-.17	.02
203395	-1.05	.45	.14
261893 a	1.15	.00	.05
261893 b	.90	.00	.08
261906	1.65	-.60	.05
3525-F	1.12	-.30	-.01
203397	-2.97*	-.07	.02
261893 c	-.32	.00	.05
162539	.40	.22	-.04
196660	-.13	2.10	.03
196677	-1.35	4.00**	.06
203396	-1.62	-1.05	.04
109839 a	.38	1.25	.05
109839 b	-.82	2.30	.07
300947	-.15	.80	.09
262090	.42	.25	.01
Florigiant	-4.55**	.45	.01
Florunner	-2.15	3.85**	.02
F_6-439	-1.22	.10	.07
F x 121067	-.30	4.00**	.13*
121067 x F	-1.57	1.87	.08
F_6-203396	-1.18	.70	.15
F_6-306230	-1.15	2.60	.03

* P = .05   ** P = .01

Table 12. Genotype-location interactions for number and size of *C. arachidicola*- and *C. personatum*-lesions and percent defoliation for peanut cultigens at the last date of assessment in 1979.

Cultigen	*C. arachidicola* lesions		*C. personatum*-lesions		Percent defol.
	Number (L_1-L_2)	Size (L_1-L_2)	Number (L_1-L_2)	Size (L_1-L_2)	(L_1-L_2)
196604	2.25	.70*	-4.35	-.50*	-.90
196652	2.45	.90**	8.53	-.50*	.40
196666	3.15*	.45	-2.40	-.45*	-3.10
196673	1.32	.40	.28	-.50*	2.10
306222	1.15	.40	2.72	-.45*	9.40**
306230 a	2.90	.70*	.47	-.25	.20
306230 b	2.47	.90**	.42	-.75**	-4.30
NC 3033	2.97*	-.10	.05	-1.05**	.20
FESR-5	-6.13**	-.30	.45	.00	5.80
196658	1.72	-.05	-3.50	.00	2.10
203395	2.45	.10	-.55	-.25	-1.90
261893 a	-1.80	.30	-2.10	.50*	3.70
261893 b	-2.97*	.00	- .95	-.50*	1.00
261906	-6.35**	-.10	11.05**	-.50*	.60
3525-F	3.42	-.10	-.73	-.50*	8.7**
203397	2.17	.35	-4.28	-.25	.80
261893 c	-2.03		-1.97	.00	-2.40
162539	.16	.25	3.75	.25	-3.40
196660	2.88	1.05**	-.98**	-.50*	-.50
196677	3.47*	.90**	-3.63	-1.00**	-.20
203396	1.93	-.25	-2.95	.00	-2.50
109839 a	2.10	.70*	3.38	.00	1.00
109839 b	1.68	1.15**	8.97**	-.25	.80
300947	2.45	1.15**	1.50	-.70**	.50
262090	1.85	.15	-4.32	.00	.70
Florigiant	8.10**	-1.00**	-3.40	-.50*	9.60
Florunner	8.30**	-.20	-8.25**	-.90**	7.30*
F_6-439	2.20	.15	-5.05	-.50*	-3.6
F x 121067	4.62**	.40	.20	-.45*	5.1
121067 x F	2.88	.30	-1.30	-1.00**	-1.70
F_6-203396	.53	.20	-3.73	-.50*	.60
F_6-306230	3.81*	.60	8.15**	-.75**	.63

* P = .05 ** P = .01

Table 13. Genotype-season interactions for number of *C. arachidicola* and *C. personatum*-lesions over locations for peanut cultigens at the last date of assessment in the combined 1978 and 1979 seasons.

Cultigen	*C. arachidicola*	*C. personatum*
	$(S_1 - S_2)$	$(S_1 - S_2)$
196604	-.89	-15.31**
196652	-.54	-15.35**
196666	1.31	-17.97**
196673	.38	-18.34**
306222	-.24	-11.47**
306230 a	-2.02	-19.21**
306230 b	-.72	- 6.44**
NC 3033	-1.83	-26.27**
FESR-5	-4.05*	.00
196658	.77	-4.54
203395	-2.13	-4.38
261893 a	-2.25	.00
261893 b	-4.92**	.00
261906	-8.71**	.00
3525-F	-3.39	-3.00
203397	-2.07	-4.79
261893 c	-4.49*	-1.50
162539	-5.33**	-3.49
196660	-2.79	-8.40**
196677	.77	-11.18**
203396	-4.86**	-6.48*
109839 a	-.69	-11.11**
109839 b	1.46	-13.20**
300947	.57	-17.50**
262090	-1.94	-2.13
Florigiant	1.67	-1.08
Florunner	.65	-5.26
F_6-439	-.10	13.48**
F x 121067	-.10	-9.85**
121067 x F	.06	-15.12**
F_6-203396	.06	- 3.27
F_6-306230	-1.26	-12.05**

* P = .05 ** P = .01

Table 14. Genotype-season interactions for number of *C. arachidicola*- and *C. personatum*-lesions within locations for peanut cultigens at the last date of assessment in the combined 1978 and 1979 seasons.

	Gainesville	Marianna	Gainesville	Marianna
Cultigen	(S_1-S_2)	(S_1-S_2)	(S_1-S_2)	(S_1-S_2)
196604	-2.30	.52	-10.18**	-20.45**
196652	-2.95	1.87	-23.00**	- 7.70*
196666	- .60	3.22	-13.05**	-19.88**
196673	.72	.05	-18.90**	-17.78**
306222	-2.60	1.88	-12.90**	-10.03**
306230 a	-1.35	.93	-17.60**	-20.83**
306230 b	-3.00	1.55	- 9.43**	- 3.45
NC 3033	-3.13	-.53	-24.40**	-28.13**
FESR-5	-5.10*	-3.00	.00	.00
196658	.67	-2.20	- 1.33	- 7.75*
203395	-1.15	-3.10	- 4.48	- 4.28
261893 a	.20	-4.70	.00	.00
261893 b	-.10	-9.75**	.00	.00
261906	2.62	-20.03**	.60	.00
3525-F	-6.20*	-.5*	-.23	- 5.78
203397	-2.80	-1.33	.12	- 9.70**
261893 c	-2.15	-6.83**	.00	- 3.00
162539	-2.38	-8.28**	- 7.60**	.62
196660	-4.48	-1.10	- 9.20*	- 7.60*
196677	-2.28	3.82	-13.43**	- 8.93*
203396	-4.55	-5.18*	- 6.45	- 6.50
109839	- .25	-1.13	- 9.98**	-12.23**
109839 b	.30	2,62	-23.23**	- 3.18
300947	- .25	1.40	-18.90**	-16.10**
262090	-2.98	-.90	.00	- 5.25
Florigiant	-1.60	4.95	- 1.55	- .60
Florunner	-5.05*	6.35*	- 1.18	- 9.33*
F_6-439	-3.60	2.37	- 2.28	-24.68**
F x 121067	-1.13	.92	-14.60**	- 5.10
121067 x F	-2.60	2.72	-12.55**	-17.68**
F_6-203396	-1.28	1.40	.75	- 7.30*
F_6-306230	-4.73	2.17	-15.98**	- 8.13*

* P = .05   ** P = .01

The genetic variance components of the phenotypic variation for all parameters assessed; i.e., the appropriate fractions of the variance, are listed in Tables 15, 16, and 17 for 1978, 1979, and the combined seasons.

The phenotypic correlations for number and size of lesions of the two pathogens ranged from .45 to .65 for *C. arachidicola* and from .62 to .80 for *C. personatum*. Number of lesions of *C. arachidicola* and *C. personatum* were negatively correlated with values ranging from -.40 to -.51. Low correlations (.26 to -.31) were obtained between size of *C. arachidicola*- and *C. personatum*- lesions. Phenotypic correlations between number of *C. arachidicola*-lesions and percent defoliation ranged from .17 to .84; for number of *C. personatum*-lesions and percent defoliation correlations were essentially zero (.01 to -.03). The phenotypic correlations between visual disease estimates and number of *C. arachidicola*-lesions ranged from .25 to .83 and for visual disease estimates and *C. personatum*-lesions from .06 to .36.

The genotypic correlations for number and size of lesions were positive and high ranging from .79 to .84 in *C. arachidicola*, and from .80 to .97 in *C. personatum*. The genotypic correlations between number of *C. arachidicola*-lesions and number of *C. personatum*-lesions were negative and ranged from -.42 to -.64. Between lesion size of both pathogens the genotypic correlation was negative (-.50).

The genotypic correlations between number of *C. arachidicola*-lesions and defoliation were positive with values ranging from .38

Table 15. Genetic components of the phenotypic variance for number and size of *C. arachidicola* and *C. personatum*-lesions, percent defoliation, and visual disease estimates for peanut cultigens at Gainesville and Marianna in 1978.

Source	Y_1[a]	Y_2	Y_3	Y_4	Y_5	Y_6
G	2.15 92.54[b]	.08 61.40	1.01 80.60	.14 75.80	21.01 86.90	132.50 92.92
GL	.00 .00	.02 15.35	.05 3.90	.02 13.54	.10 .43	2.20 1.54
GR(L)	.02 .91	.03 22.30	.04 3.20	.02 10.30	.62 2.60	.83 .58
GD	.10 4.30	.00 .20	.13 10.10	.00 .00	1.57 6.50	5.83 4.10
GDL	.01 .60	.00 .00	.00 .00	.00 .00	.29 1.20	.52 .40
GDR(L)	.04 1.70	.00 .00	.03 2.20	.00 .00	.58 2.40	.71 .50
Phen. Var.	2.32	.13	1.26	.18	24.17	142.59

[a] Y_1 = *C. arachidicola*-lesion number Y_2 = *C. arachidicola*-lesion size

Y_3 = *C. personatum*-lesion number Y_4 = *C. personatum*-lesion size

Y_5 = Percent defoliation Y_6 = Visual disease estimates

[b] Bottom figures mean percent of phenotypic variance.

Table 16. Genetic components of the phenotypic variance for number and size of *C. arachidicola*- and *C. personatum*-lesions, percent defoliation, and visual disease estimates for peanut cultigens at Gainesville and Marianna in 1979.

Source	Y_1[a]	Y_2	Y_3	Y_4	Y_5	Y_6
G	4.04 69.50[b]	.07 44.62	21.34 75.17	.09 70.87	3.33 21.75	91.87 87.00
GL	.27 4.65	.01 6.29	.69 2.43	.01 3.94	.58 3.79	5.99 5.67
GR(L)	.06 1.03	.001 .63	.28 .99	.001 .79	.07 .46	.43 .47
GD	.17 2.93	.001 .63	1.52 5.35	.004 3.15	.31 2.02	5.39 5.10
GDL	.11 1.89	.002 1.26	.60 2.11	.002 1.57	.13 .85	1.23 1.16
GDR(L)	.03 .54	.001 .63	.12 .42	.001 .79	.06 .39	.69 .65
Error	1.13 19.45	.07 46.54	3.84 13.53	.02 18.90	10.83 70.74	-- --
Phenotypic variance	5.81	.15	28.39	.13	15.31	105.60

[a] Y_1 = *C. arachidicola*-lesion number Y_2 = *C. arachidicola*-lesion size

Y_3 = *C. personatum*-lesion number Y_4 = *C. personatum*-lesion size

Y_5 = Percent defoliation Y_6 = Visual disease estimates

[b] Bottom figures mean percent of phenotypic variance

Table 17. Genetic components of the phenotypic variance for number of *C. arachidicola*- and *C. personatum*-lesions for peanut cultigens at Gainesville and Marianna in the combined 1978 and 1979 seasons.

Source	*C. arachidicola*	*C. personatum*
G	2.67 72.36[a]	5.52 41.94
GS	.48 13,01	5.62 42.70
GL	.14 3.79	.12 .91
GLS	.09 2.43	.53 4.03
GR(L,S)	.01 .27	.01 .08
GD	.10 2.71	.46 3.49
GDS	.08 .81	.41 3.11
GDL	.00 .00	.00 .00
GDLS	.07 1.90	.26 1.98
GDR(L,S)	.10 2.71	.23 1.75
Phenotypic variance	3.69	13.16

[a] Bottom figures indicate percent of the phenotypic variance.

to .88. *C. personatum*-lesions and defoliation were not genotypically correlated (-.03 to -.05).

A heritability estimate of .72 was obtained for number of *C. arachidicola*-lesions. For number of *C. personatum*-lesions the heritability estimate was .42.

The mean squares, degrees of freedom, and F values from the analysis for the greenhouse tests are presented in Table 18. Location means for number of *C. arachidicola*- and *C. personatum*-lesions, and for percent defoliation following inoculation with spore population samples of *C. arachidicola*, *C. personatum*, and both pathogens simultaneously, are presented in Table 19. The differences between location means were not significant for number of *C. arachidicola* and *C. personatum*-lesions, and for percent defoliation. The mean number of *C. arachidicola*-lesions (38.43) produced by *C. arachidicola* inoculum was significantly different from that produced by *C. arachidicola* plus *C. personatum*-inoculum (26.92) (P = .05). Also, the mean number of *C. personatum*-lesions (29.35) produced by *C. personatum*-inoculum was significantly different from that produced by *C. arachidicola* plus *C. personatum*-inoculum (1.86) (P = .05). Differences in percent defoliation caused by the three inocula were significant (P = .05).

In Table 20 are listed the cultigen means for number of *C. arachidicola* and *C. personatum*-lesions, and for percent defoliation following inoculation with spore population samples of *C. arachidicola* *C. personatum*, and *C. arachidicola* plus *C. personatum*.

Inoculum mean differences for number of *C. arachidicola*-lesions were significant, except for cultigen 203397. All inoculum mean

Table 18. Mean squares and F values for number of Cercospora-leafspot lesions and percent defoliation of cultigens following inoculation in the greenhouse in 1979.

Source	d.f.	No. of *C. arach.*-lesions		No. of *C. pers.*-lesions		Percent defoliation	
		MS	F	MS	F	MS	F
L	1	602.82	3.81	20.05	.15	256.89	1.14
I	2	84067.00	532.07**	58319.00	442.35**	22560.66	100.10**
G	8	887.45	5.62**	1157.48	8.78**	3845.89	17.06**
IG	16	321.02	2.03*	874.99	6.64**	506.89	2.25**
e	620	157.99		131.84		225.38	

* = Significant at P = .05 ** = Significant at P = .01

Table 19. Location means for number of *C. arachidicola*- and *C. personatum*-lesions and percent defoliation on peanut cultigens following inoculation in the greenhouse with *C. arachidicola*, *C. personatum*, and the combined pathogens in 1979.

	C. arach.-lesions			*C. pers.*-lesions			Percent defoliation		
Inoculum	GV[a]	MA[b]	$\bar{x}$	GV	MA	$\bar{x}$	GV	MA	$\bar{x}$
C. arachidicola	40.52	36.35	38.43	.00	.00	.00	63.00	61.89	62.44
C. personatum	.00	.00	.00	29.33	29.36	29.35	36.81	47.96	42.39
C. arach. + *C. pers.*	27.73	26.12	26.92	1.35	2.38	1.86	58.96	52.70	55.83
	22.75	20.83		10.22	10.58		52.93	54.18	

[a] GV = Gainesville

[b] MA = Marianna

Table 20. Cultigen means for number of *C. arachidicola*- and *C. personatum*-lesions and percent defoliation following inoculation with *C. arachidicola*, *C. personatum*, and the combined pathogens in the greenhouse in 1979.

Cultigens	*C. arachidicola*-inoculum			*C. personatum*-inoculum			*C. arach* + *C. pers*-inoculum		
	C. arach-lesions	*C. pers*-lesions	Percent defol.	*C. arach*-lesions	*C. pers*-lesions	Percent defol.	*C. arach*-lesions	*C. pers*-lesions	Percent defol.
(1) 261906	31.00 a[1]	.00	67.33 b	.00	25.62 ab	48.33 bc	22.80 abc	1.21 a	57.17 ab
(2) 261893 a	40.80 abc	.00	61.17 ab	.00	24,04 a	47.83 bc	28.80 bcd	.54 a	51.83 a
(3) 203397	41.00 abcd	.00	65.50 b	.00	35.08 c	51.00 c	35.50 d	1.12 a	65.50 b
(4) 306230 b	32.90 ab	.00	64,50 b	.00	32,29 bc	49.67 bc	22.00 ab	1.50 a	59.33 ab
(5) 196604	40,70 abc	.00	68.33 b	.00	32.17 bc	51.50 c	29.80 bcd	3.17 a	62.50 b
(6) 196660	33.20 ab	.00	54.17 a	.00	10.25	21.83	18.10 a	.92 a	35.00
(7) 162539	33.90 ab	.00	53.33 a	.00	28.21 abc	39.83 ab	26,10 bcd	2.62 a	60.17 ab
(8) E. Bunch	48.50 d	.00	62.00 ab	.00	50.71	37.17 a	30.50 cd	3.58 a	52.33 a
(9) Florunner	44.10 cd	.00	65.58 b	.00	25.75 ab	34.33 a	28.60 bcd	2.12 a	58.67 ab

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[1] Any two means with the same letter are not significantly different at level $P = .05$ (Duncan's multiple range test).

differences for number of *C. personatum*-lesions were significant. For percent defoliation most inoculum mean differences were significant (Table 21).

Table 21. Mean differences due to inoculum for number of *C. arachidicola*- and *C. personatum*-lesions and percent defoliation in the greenhouse in 1979.

	C.a.-les.	*C.p.*-les.	Percent defoliation		
Cultigens	$I_1 - I_3$	$I_2 - I_3$	$I_1 - I_2$	$I_1 - I_3$	$I_3 - I_2$
261906	8.20*	24.41**	19.00**	10.16*	8.84*
261893 a	12.00**	23.50**	13.34**	9.34*	4.00
203397	5.5	33.96**	14.50**	.00	14.50**
306230 b	10.50**	30.79**	14.83**	5.17	9.66*
196604	10.90**	29.00**	16.83**	5.83	11.00**
196660	15.10**	9.33*	32.34**	19.17**	13.17**
162539	7.80*	25.59**	13.50**	-6.84	20.34**
Early Bunch	18.00**	47.13**	24.83**	10.33**	15.16**
Florunner	15.50**	23.63**	31.25**	6.91	24.34**

* P = .05   ** P = .01

I_1 = *C. arachidicola* inoculum,

I_2 = *C. personatum* inoculum, and

I_3 = *C. arachidicola* plus *C. personatum* inoculum.

DISCUSSION

For both *Cercospora arachidicola* and *Cercosporidium personatum*, visual disease estimates were used to monitor disease progress, to obtain time for the disease to reach X_T = .50, and to rank cultigens for resistance.

In 1977, when the cultigen population was comprised of a wide range of susceptible and resistant cultigens, differentiation was made satisfactorily by visual disease estimates. In 1978 and 1979, the population involved selected cultigens within a narrow range of resistance and differentiation between cultigens by visual disease estimates was difficult. Ranking of cultigens by visual estimates was very dependent on the pathogen species prevalent in a particular location and season. With few exceptions, in a season of high *C. arachidicola*-disease pressure, *C. arachidicola*-susceptible cultigens were scored as susceptible to Cercospora leafspot diseases, whereas in seasons of high *C. personatum*-disease pressure, the same cultigens were scored as resistant. By the end of the season most of the cultigens were not significantly different from each other in regard to visual disease estimates. Thus, selection of resistant material by this assessment is not suitable in regions in which the predominance of the pathogen species changes from season to season or even during the season. Reduction of disease development on resistant cultigens was primarily due to the reduction of the number of infections and a maturity type of resistance that was apparent from 80 to 90 days to the end of the season. After 90 days, the magnitude of the infection rates (r values) decreased in the resistant cultigens and increased in the susceptible ones. Thus, at the end of the season, most of the susceptible cultigens were completely diseased while the resistant cultigens, although with high levels of disease, still showed green foliage. In addition, the time required to reach a disease proportion of $X_T = 0.5$ was delayed approximately two weeks in the resistant cultigens. Although the resistant cultigens exhibited less disease than the susceptible ones throughout the season, disease development was more rapid in the resistant cultigens until 90 days, as indicated by the high r values. Plaut and Berger (personal communication) also observed a faster disease development on resistant cultigens at the early stages of the disease epidemics but the epidemics began at lower initial disease levels for resistant cultigens. No explanation has been given for it.

The area under disease progress curve (AUDPC) was not a good estimate of the reduction of disease among cultigens within a narrow range of resistance. The AUDPC was useful to estimate only the reduction in diseased area by using resistant cultigens in relation to susceptible ones.

Number of lesions constituted the most reliable parameter for differentiating cultigens with resistance to *C. arachidicola*- and *C. personatum*-leafspots. On most observation dates, cultigens classified as resistant consistently had a lower number of lesions in both locations and seasons than the others. No lesions, or very few were recorded prior to 50 days, and prior to 80 days very few differences were observed between cultigens. Thus, disease assessment for number of lesions was useless for cultigen differentiation prior to 80 days. From 80 to 120 days the range between the low and the high number of lesions was wide enough to allow cultigen differentiation. Slight but not significant increments in the number of lesions were detected by scoring weekly; the utilization of two-week intervals, however, did result in significant changes in number of lesions. After 120 days a declination in the number of lesions was observed and cultigen differentiation then became difficult. This was observed also by Miller (1953) who pointed out that with new leaf formation and excessive leaf shedding lesion numbers started to decline and lesion counts became valueless.

As expected, in most locations and seasons more *C. arachidicola*-lesions were present early in the season, and more *C. personatum*-lesions late in the seasons. However, in 1979 at Marianna *C. personatum* had an early season pressure similar to that of *C. arachidicola*. Plants under high *C. personatum*-disease pressure displayed the same total disease (visual disease estimates plus defoliation) values as plants under high *C. arachidicola*-pressure; thus, it is not known whether *C. personatum* was more, or less destructive than *C. arachidicola*. However, Plaut and Berger (1980) indicated that in Florida *C. personatum*-epidemics are more destructive than *C. arachidicola*-epidemics.

The rank of cultigens was quite consistent for numbers of *C. arachidicola*- and *C. personatum*-lesions in 1978 and 1979. The cultigens with the fewest lesions of *C. arachidicola* were usually not the same as those with the fewest lesions of *C. personatum*. For both pathogens, a wide range in number and size of lesions was displayed between the most resistant and the susceptible cultigens.

The cultigens with resistance to *C. arachidicola* were different from those with resistance to the disease complex (both pathogens simultaneously). In 1979, a year with high *C. personatum*-disease pressure, only *C. personatum*-resistant cultigens were included among the ones with resistance to the disease complex. Selection by disease complex resistance would result in a tendency to discard *C. arachidicola*-resistant cultigens in season of heavy *C. personatum*-disease pressure. Since information is unavailable on the relative frequencies of *C. personatum*- and *C. arachidicola*-epidemics, differentiation of the pathogens is very important when selecting for resistance to Cercospora leafspots.

A significant genotype-season interaction was obtained for number of lesions and for *C. arachidicola*-lesion size when averaged over locations. Genotype-location interactions for number and size of lesions were detected within seasons. The significant genotype-location and genotype-season interactions for number and size of lesions of a pathogen were usually observed in cultigens susceptible to that pathogen; i.e., resistant cultigens showed no significant changes with location or season. Lesions size was found to be related to lesion numbers. Cultigens with fewer lesions of one pathogen also exhibited smaller lesion sizes.

No disease, or very few lesions, were recorded prior to 50 days, and no important leaf shedding took place prior to this date. Defoliation was detected only after the presence of the pathogens. Plants were more affected in the intermediate stages of their growth. Approximately 50 percent of the total defoliation took place when the plants were 50 to 80 days old. All cultigens were more than 75 percent defoliated at maturity. The relationship between number and size of lesions and defoliation was not easy to establish since other factors, such as translocation and available soil moisture, influenced defoliation. However, in both field and greenhouse tests defoliation was correlated more with *C. arachidicola*- than with *C. personatum*-infection.

Positive correlation values were obtained between number and size of lesions, i.e., genes conditioning resistance to leafspots cause a simultaneous variation of both characteristics. Thus, selection for reduced number of lesions should also select for reduced lesion size.

Both number and size of lesions of one pathogen were negatively correlated with those of the other pathogen. This means that the same set of genes may influence the two characteristics of both diseases, increasing the number and size of lesions for one pathogen, while decreasing them for the other. These results agree with observations by Higgins (1935) and Abdou et al. (1974) who reported that cultigens exhibiting resistance to one pathogen were susceptible to the other.

A reduction in number of *C. personatum*-lesions was observed in the greenhouse with inoculations of a mixed spore sample of *C. arachidicola* and *C. personatum*, compared to the number induced by *C. personatum* when inoculated alone. This reduction might be either from the result of a lower spore concentration of *C. personatum* (from 20,000 to 10,000 spores/ml) in the *C. arachidicola*- plus *C. personatum*-inoculum or to an interaction between the two pathogens. In this interaction, the development of *C. arachidicola*-lesions might have inhibited the development of *C. personatum*-lesions, the extent depending on the genotype of the plant. More detailed studies, with various spore concentration levels and selected cultigens with known field resistance that are tested in different locations and seasons, are required to clarify this situation.

The number of lesions caused by both pathogens was found to be a highly heritable trait. Sharief et al. (1978) obtained high heritabilities for number of lesions in F_2 populations derived from crosses between resistant and susceptible peanut species. In my work, the heritability estimates ranged from .70 to .96 for number of *C. arachidicola*-lesions and from .75 to .81 for number of *C. personatum*-lesions. Since negative correlated responses existed, if selection is made for one pathogen, and the other ignored, the selected population would exhibit a low number of lesions of the pathogen against which the selection was made, and a correspondingly high number of lesions of the ignored pathogen. Thus, if progress in breeding for simultaneous resistance to both pathogens is intended, it will be necessary to select cultigens displaying a low number of lesions of both pathogens.

To achieve a maximum improvement of economic value, a selection index should be applied to both diseases giving an appropriate weight to each disease according to its relative economic importance, its heritability, and the genotypic and phenotypic correlations between the two diseases. As it seems that *C. personatum* is currently more important than *C. arachidicola* in Florida, higher economic values might be assigned to the former than to the latter.

CONCLUSIONS

1. In this three-year study, a wide range of resistance to Cercospora leafspot, expressed as reduced number and size of lesions, as well as a lower percent of defoliation, was found among *Arachis hypogaea* L. cultigens.
2. Disease readings taken at two week intervals commencing 80 days after planting were sufficient to detect cultigen differences.
3. Receding of epidemics in resistant cultigens not only occurred from the reduction in the number of infection sites but also from resistance at maturity.
4. Visual disease estimates and percent defoliation were not reliable parameters of disease assessment between cultigens with intermediate levels of resistance. Cultigens were better differentiated by contrasting the number of lesions induced by each pathogen.
5. Few lesions of one pathogen were associated with many lesions of the other. For both pathogens low lesion numbers were associated with small lesion size.
6. Cultigens resistant in one location or season were usually resistant in the other location or seasons.
7. A simultaneous genetic variation obtained for both pathogens infers that both number and size of lesions contribute to resistance.

8. Since number and size of lesions induced by one pathogen were negatively correlated genetically with those induced by the other, progress in breeding for resistance to both pathogens will be achieved by selection applied simultaneously to both diseases, appropriate weight being given to each disease according to its relative economic importance.
9. In these tests, *C. arachidicola* was responsible for most of the defoliation.
10. *C. personatum*-lesion numbers were reduced in greenhouse tests by the presence of *C. arachidicola*. A more detailed study is needed to clarify these findings.

APPENDIX

Table I

Peanut cultigens screened for resistance to Cercospora leafspot diseases at Gainesville and Marianna in 1978 and 1979.

Cultigen	Cultigen
PI 196604	PI 261893 c
PI 196652	PI 162539
PI 196666	PI 196660
PI 196673	PI 196677
PI 306230 a	PI 203396
PI 306230 b	PI 109839 a
NC 3033	PI 109839 b
F.E.S.R.-5-	PI 300947
PI 196658	PI 262090
PI 203395	Florigiant
PI 261893 a	Florunner
PI 261893 b	F_6-439- x145681 *
PI 261906	F_6-Flor.x 121067 *
3525 F_2	F_6-121067 x Flor.* †
PI 203397	F_6-203396 x Flor.*
PI 306222	F_6-306230 x Flor.*

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* = Provided by D. W. Gorbet from Marianna, Fl.

† Flor. = Florunner.

Table II

Peanut cultigens inoculated in greenhouse with population samples of *C. arachidicola* and *C. personatum* in 1979.

Cultigen	Assumed resistance to
PI 261906	*C. personatum*
PI 162539	*C. personatum* + *C. arachidicola*
PI 261893 [a]	*C. personatum*
PI 203397	*C. personatum*
PI 306230 [b]	*C. arachidicola*
PI 196604	*C. arachidicola*
PI 196660	*C. arachidicola* + *C. personatum*
Early Bunch	Susceptible
Florunner	Susceptible

Table III

Field screening for resistance to Cercospora leafspot diseases of peanuts X_T values (visual disease estimates plus defoliation) at Gainesville in 1978.

Cultigens	Days after planting										
	48*	71	78*	85	92*	99*	106*	113*	120*	127	134
196604	.005	.12	.19	.36	.36	.47	.48	.67	.76	.75	.81
196652	.007	.13	.21	.35	.33	.42	.45	.63	.76	.77	.80
196666	.010	.14	.22	.36	.35	.42	.58	.68	.79	.79	.83
196673	.010	.13	.21	.37	.39	.47	.45	.59	.70	.73	.83
306222	.017	.14	.29	.49	.54	.63	.73	.84	.88	.84	.88
306230 a	.007	.10	.18	.38	.30	.41	.41	.66	.72	.78	.81
306230 b	.010	.10	.17	.33	.32	.43	.39	.62	.69	.70	.79
NC 3033	.012	.18	.28	.43	.55	.67	.68	.81	.87	.86	.86
FESR-5	.08	.29	.43	.57	.73	.80	.92	.94	.95	.97	.96
196658	.007	.19	.36	.43	.39	.47	.54	.68	.73	.74	.80
203395	.03	.19	.19	.38	.31	.44	.55	.60	.67	.75	.82
261893 a	.01	.12	.24	.35	.38	.46	.57	.66	.81	.81	.82
261893 b	.02	.16	.22	.36	.41	.44	.47	.66	.76	.79	.83
261906	.02	.19	.26	.38	.44	.46	.58	.69	.80	.79	.84
3525-F†	.012	.19	.29	.42	.53	.62	.79	.86	.94	.94	.98
203397	.02	.15	.24	.32	.31	.41	.47	.59	.75	.75	.81
261893 c	.012	.15	.25	.37	.36	.41	.55	.72	.78	.80	.81
162539	.02	.27	.33	.42	.45	.65	.64	.68	.80	.79	.81
196660	.012	.15	.19	.32	.33	.42	.46	.62	.75	.72	.78
196677	.015	.18	.26	.40	.33	.52	.56	.75	.75	.78	.82
203396	.015	.15	.21	.36	.31	.42	.49	.54	.75	.72	.81
109839 a	.01	.26	.24	.42	.33	.45	.53	.63	.73	.73	.83
300947	.01	.16	.26	.38	.36	.45	.45	.62	.70	.80	.82
262090	.012	.13	.22	.33	.34	.45	.54	.64	.77	.80	.83
Florigiant	.04	.32	.37	.53	.67	.69	.92	.94	.98	.98	.99
Florunner	.05	.20	.31	.45	.52	.64	.86	.94	.97	.99	.99
F_6-439	.02	.22	.25	.37	.29	.41	.48	.60	.73	.78	.82
F x 121067††	.012	.15	.21	.40	.34	.49	.51	.68	.76	.81	.90
121067 x F‡	.01	.20	.24	.39	.39	.45	.54	.70	.84	.84	.88
F_6-203396‡‡	.012	.20	.24	.39	.36	.43	.50	.69	.70	.75	.80
F_6-306230∞	.012	.16	.22	.42	.39	.60	.71	.81	.84	.85	.87
Min. disease	.005	.10	.17	.32	.29	.41	.39	.54	.67	.70	.78
Max. disease	.08	.32	.43	.57	.73	.80	.92	.94	.98	.99	.99
Avg. disease	.017	.17	.25	.39	.40	.50	.57	.73	.79	.80	.84

* = Periods computed for analysis of variance.

† 325-F = 3525-F_2

†† F x 121067 = F_6-Florunner x 121067

‡ 121067 x F = F_6-121067 x Florunner

‡‡ F_6-203396 = F_6-203396 x Florunner

∞ F_6-306230 = F_6-306230 x Florunner

Table IV

Field screening for resistance to Cercospora leafspot diseases of peanuts. X_T values (visual disease estimates plus defoliation) at Marianna in 1978.

Cultigens	Days after planting							
	52*	66	80*	94*	100*	107*	114*	121*
196604	.01	.09	.22	.55	.61	.69	.77	.77
196652	.01	.27	.21	.53	.68	.69	.80	.82
196666	.017	.08	.25	.61	.67	.66	.75	.78
196673	.03	.12	.26	.60	.70	.66	.78	.78
306222	.015	.12	.31	.68	.76	.77	.83	.82
306230 a	.01	.08	.18	.48	.67	.63	.73	.81
306230 b	.01	.08	.17	.49	.62	.66	.76	.77
NC 3033	.08	.11	.63	.75	.81	.84	.84	.84
FESR-5	.05	.25	.61	.92	.96	.96	.99	.99
196658	.02	.07	.24	.56	.66	.65	.76	.75
203395	.03	.12	.25	.62	.69	.67	.80	.81
261893 a	.02	.10	.31	.64	.76	.72	.82	.86
261893 b	.02	.15	.31	.67	.73	.73	.81	.84
261906	.03	.11	.32	.70	.76	.78	.83	.85
3525-F	.013	.12	.30	.83	.87	.87	.93	.93
203397	.03	.14	.28	.56	.67	.67	.76	.77
261893 c	.02	.10	.31	.66	.75	.72	.82	.83
162539	.03	.12	.30	.77	.74	.78	.79	.76
196660	.01	.09	.27	.57	.60	.65	.72	.78
196677	.02	.17	.27	.53	.69	.66	.79	.81
203396	.03	.16	.28	.64	.68	.71	.75	.79
109839 a	.01	.11	.27	.62	.63	.70	.77	.78
109839 b	.01	.11	.24	.55	.65	.66	.74	.79
300947	.01	.11	.24	.63	.64	.68	.76	.79
262090	.015	.10	.28	.54	.74	.71	.81	.78
Florigiant	.05	.16	.40	.75	.95	.95	.99	.99
Florunner	.04	.16	.36	.80	.94	.95	.99	.99
F_6-439	.03	.13	.25	.62	.58	.68	.76	.80
F x 121067	.03	.16	.26	.65	.76	.76	.84	.89
121607 x F	.03	.12	.25	.62	.76	.82	.91	.92
F_6-203396	.02	.13	.23	.54	.70	.69	.80	.85
F_6-306230	.02	.07	.27	.71	.78	.81	.87	.87
Min. disease	.01	.07	.17	.48	.58	.63	.72	.75
Max. disease	.08	.27	.63	.92	.96	.96	.99	.99
Avg. disease	.02	.13	.29	.64	.72	.74	.81	.83

* = Periods computed for analysis of variance.

Table V

Field screening for resistance to Cercospora leafspot diseases of peanuts. X_T values (visual disease estimates plus defoliation) at Gainesville in 1979.

	Days after planting						
Cultigens	49	80	93	100	107	114	121
196604	.02	.47	.67	.75	.80	.90	.91
196652	.02	.49	.69	.78	.82	.88	.90
196666	.02	.48	.63	.78	.82	.88	.92
196673	.02	.45	.69	.79	.80	.92	.91
306222	.02	.40	.77	.84	.91	.94	.98
306230 a	.02	.39	.58	.77	.83	.82	.88
306230 b	.02	.57	.61	.68	.81	.89	.88
NC 3033	.02	.47	.86	.93	.90	.94	.97
FESR-5	.02	.53	.84	.91	.94	.97	.98
196658	.02	.54	.69	.78	.77	.89	.85
203395	.02	.46	.59	.75	.81	.83	.91
261893 a	.02	.53	.73	.82	.76	.90	.86
261893 b	.02	.52	.70	.80	.79	.82	.90
261906	.02	.46	.77	.82	.83	.88	.90
3525-F	.02	.45	.78	.83	.94	.96	.99
203397	.02	.42	.62	.80	.77	.81	.88
261893 c	.02	.49	.71	.74	.81	.88	.89
162539	.02	.54	.76	.79	.82	.88	.90
196660	.02	.49	.65	.78	.82	.87	.90
196677	.02	.46	.69	.75	.81	.89	.93
203396	.02	.43	.66	.76	.77	.86	.88
109839 a	.02	.52	.66	.76	.78	.90	.88
109839 b	.02	.53	.69	.72	.81	.86	.92
300947	.02	.50	.69	.73	.83	.90	.93
262090	.02	.42	.69	.78	.84	.88	.93
Florigiant	.02	.51	.85	.89	.95	.96	.99
Florunner	.04	.53	.90	.92	.97	.99	.99
F_6-439	.02	.52	.73	.71	.81	.90	.91
F x 121067	.02	.47	.75	.75	.89	.93	.96
121067 x F	.02	.50	.75	.77	.87	.91	.95
F_6-203396	.02	.54	.65	.77	.78	.87	.91
F_6-306230	.02	.46	.77	.84	.88	.93	.97
Max. disease	.04	.57	.86	.93	.97	.99	.99
Min. disease	.02	.39	.58	.68	.76	.81	.85
Avg. disease	.02	.48	.71	.79	.84	.89	.92

Table VIII

Field screening for resistance to Cercospora leafspot diseases of peanuts. X_T values (visual disease estimates plus defoliation) at Marianna in 1979.

	Days after planting						
Cultigens	49	80	93	100	107	114	121
196604	.00	.55	.64	.73	.83	.88	.92
196652	.00	.46	.67	.77	.84	.86	.86
196666	.00	.54	.57	.78	.86	.88	.90
196673	.00	.61	.71	.76	.89	.87	.87
306222	.00	.60	.74	.75	.89	.91	.89
306230 a	.00	.55	.64	.71	.87	.87	.90
306230 b	.00	.57	.59	.77	.88	.88	.89
NC 3033	.00	.56	.78	.77	.91	.95	.92
FESR-5	.00	.55	.71	.85	.91	.92	.93
196658	.00	.52	.56	.71	.81	.87	.79
203395	.00	.43	.64	.79	.89	.90	.90
261893 a	.00	.47	.59	.79	.82	.84	.88
261893 b	.00	.46	.57	.80	.83	.86	.88
261906	.00	.55	.67	.68	.83	.86	.92
3525-F	.00	.58	.70	.87	.87	.92	.92
203397	.00	.55	.60	.74	.84	.88	.85
261893 c	.00	.47	.55	.75	.86	.85	.89
162539	.00	.55	.58	.80	.82	.83	.90
196660	.00	.58	.62	.76	.88	.86	.88
196677	.00	.52	.68	.81	.86	.88	.87
203396	.00	.48	.60	.71	.85	.82	.88
109839 a	.00	.55	.70	.74	.84	.88	.86
109839 b	.00	.63	.70	.76	.89	.89	.90
300947	.00	.49	.70	.75	.90	.91	.89
262090	.00	.49	.54	.73	.87	.81	.88
Florigiant	.00	.61	.75	.86	.92	.93	.96
Florunner	.00	.56	.78	.88	.94	.95	.98
F_6-439	.00	.48	.70	.78	.90	.88	.92
F x 121067	.00	.53	.71	.85	.87	.93	.89
121067 x F	.00	.48	.69	.78	.88	.93	.92
F_6-203396	.00	.48	.66	.71	.85	.86	.87
F_6-306230	.00	.58	.56	.83	.86	.91	.88
Max. disease	.00	.63	.78	.86	.94	.95	.98
Min. disease	.00	.43	.54	.68	.81	.82	.85
Avg. disease	.00	.53	.65	.76	.87	.88	.89

Table VII

Field screening for resistance to Cercospora leafspot diseases of peanuts. X_T values (visual disease estimates plus defoliation) over locations and seasons at Gainesville and Marianna in the combined 1978 and 1979 seasons.

	Days after planting						
Cultigens	49	80	93	100	107	114	121
196604	.01	.35	.55	.64	.70	.80	.83
196652	.01	.34	.55	.66	.69	.79	.83
196666	.01	.37	.54	.66	.73	.79	.85
196673	.01	.38	.59	.68	.69	.78	.81
306222	.01	.39	.68	.74	.82	.87	.89
306230 a	.01	.32	.50	.64	.68	.77	.82
306230 b	.01	.37	.50	.62	.68	.76	.83
NC 3033	.02	.48	.73	.79	.82	.88	.90
FESR-5	.04	.53	.79	.87	.93	.95	.96
196658	.01	.41	.55	.65	.69	.79	.78
203395	.02	.33	.54	.66	.73	.78	.82
261893 a	.01	.38	.58	.70	.71	.81	.85
261893 b	.01	.37	.58	.69	.70	.78	.84
261906	.01	.39	.64	.68	.75	.81	.86
3525-F	.01	.40	.69	.79	.86	.91	.94
203397	.01	.37	.52	.65	.68	.75	.81
261893 c	.01	.38	.56	.66	.73	.81	.84
162539	.01	.42	.63	.74	.76	.79	.84
196660	.01	.38	.54	.64	.70	.76	.82
196677	.01	.38	.48	.69	.72	.82	.84
203396	.01	.35	.55	.65	.70	.74	.82
109839 a	.01	.39	.57	.64	.69	.79	.81
109839 b	.01	.46	.56	.64	.71	.77	.83
300947	.01	.37	.51	.64	.71	.79	.82
262090	.01	.35	.45	.67	.74	.78	.84
Florigiant	.02	.47	.75	.84	.93	.95	.97
Florunner	.03	.44	.75	.84	.93	.94	.98
F_6-439	.01	.36	.58	.62	.71	.73	.84
F x 121067	.01	.36	.61	.71	.75	.77	.87
$F_6$203396	.01	.37	.55	.65	.68	.73	.83
F_6-306230	.01	.38	.60	.74	.81	.84	.73
Max. disease	.04	.48	.75	.87	.93	.95	.98
Min. disease	.01	.34	.45	.62	.68	.73	.73
Avg. disease	.01	.39	.59	.69	.75	.81	.85

Table VIII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. arachidicola*-lesions per leaflet at Gainesville in 1978.

Cultigens	Days after planting										
	48*	71	78*	85	92*	99*	106*	113*	120*	127	134
196604	.10	.85	.37	.35	.87	2.12	1.82	2.72	1.95	1.85	1.92
196652	.08	1.17	.97	.45	.90	1.40	2.62	2,05	1.55	2.47	1.30
196666	.15	.87	1.35	.70	.97	3.17	1.62	2.52	3.90	4.02	1.45
196673	.10	1.17	.65	.37	1.50	3.02	2.87	3.92	4.47	3.77	1.37
306222	.12	2.05	.75	1.15	1.65	2.02	2.25	1.50	2.40	1.85	1.15
306230 a	.09	.70	.42	.25	.62	1.30	1.22	1.60	1.90	1.87	.97
306230 b	.12	.77	.45	.55	.77	2.10	.97	1.92	1.25	1.15	1.60
NC 3033	.17	1.27	1.80	.45	1.02	1.17	3.07	1.37	2.12	3.07	2.10
FESR-5	.27	5.67	1.80	7.80	8.02	8.00	11.62	10.37	7.15	5.70	4.12
196658	.10	1.17	1.12	.52	2.17	2.72	3.12	4.07	5.17	5.37	2.35
203395	.22	1.00	1.12	.50	.82	1.85	3.20	3.50	4.10	3.97	1.55
261893 a	.15	.80	.47	.60	1.10	2.40	3.70	3.55	4.70	4.45	1.77
261893 b	.17	.72	.47	.75	1.17	1.80	3.50	3.42	4.15	5.02	2.22
261906	.17	.60	.72	.32	.80	2.32	3.35	4.10	6.12	4.50	2.70
3525-F	.15	2.17	.65	1.82	3.27	5.85	5.15	9.50	7.05	6.80	4.07
203397	.20	1.67	.85	.37	1.07	1.12	2.30	2.90	3.20	4.60	2.52
261893 c	.17	1.40	.40	.42	1.05	1.87	2.85	4.72	3.35	5.07	2.45
162539	.17	1.80	1.70	.47	2.92	4.12	6.87	5.07	5.12	4.67	2.72
196660	.12	1.10	.10	.52	.55	2.32	2.70	3.15	3.27	2.45	1.90
196677	.15	1.47	1.02	1.45	1.75	2.82	2.92	2.85	2.47	2.57	1.22
203396	.20	1.25	.62	.52	.62	1.37	1.17	2.10	2.95	3.22	2.27
109839 a	.15	1.42	.42	.17	1.60	2.92	2.92	1.45	2.75	3.17	2.00
109839 b	.17	1.77	.80	.27	.85	1.87	1.57	2.82	2.05	1.97	1.40
300947	.10	2.00	.47	.37	1.10	1.77	2.65	2.30	3.25	3.55	1.47
262090	.15	1.05	.40	.37	1.50	2.77	3.07	4.02	5.77	4.62	2.70
Florigiant	.42	5.65	3.30	2.80	5.75	9.00	17.15	8.37	9.65	6.15	4.10
Florunner	.37	3.50	.62	.97	2.32	2.80	3.02	6.70	6.70	4.87	1.87
F_6-439	.20	1.42	.37	.70	1.17	2.30	2.40	2.32	3.40	5.80	2.92
F x 121067	.22	1.97	.72	1.02	1.92	2.70	3.22	3.17	2.87	3.50	1.85
121067 x F	.22	1.12	.67	.97	1.45	2.45	.97	2.50	1.65	3.02	.90
F_6-203396	.12	1.17	.22	.40	1.27	1.80	1.47	2.47	3.72	2.95	2.40
F_6-326230	.25	1.62	.32	.55	.85	2.92	1.52	2.07	1.27	1.77	.95
Min. No. les	.08	.60	.10	.17	.55	1.12	.97	1.37	1.25	1.15	.90
Max. No. les	.42	5.67	3.30	7.80	8.02	9.00	17.15	10.37	9.65	6.80	4.12
Avg. No. les	,16	1.64	.82	.90	1.67	2.75	3.40	3.60	3.79	3.63	2.07

* Periods computed for analysis of variance,

Table IX

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. arachidicola*-lesions per leaflet at Marianna in 1978.

Cultigens	Days after planting							
	52*	66	80*	94*	100*	107*	114*	121*
196604	.20	.55	2.32	1.17	1.60	1.87	2.90	1.77
196652	.52	.80	.67	4.47	1.77	2.62	3.45	4.37
196666	.45	.62	1.90	2.00	1.92	2.75	3.55	3.47
196673	.92	1.00	2.55	2.40	3.65	3.77	5.40	5.80
306222	.37	2.50	2.10	3.72	3.25	3.52	3.72	4.12
306230 a	.45	.52	1.45	1.92	1.62	2.40	2.10	1.57
306230 b	.37	1.07	1.52	1.20	1.95	1.72	2.35	1.55
NC 3033	.62	.80	4.00	3.30	3.25	3.42	3.32	3.47
FESR-5-2	.85	5.55	6.22	8.37	9.37	7.40	14.47	10.00
196658	.12	.80	2.70	2.92	3.72	3.47	5.40	3.80
203395	.67	1.87	2.22	4.05	4.77	3.62	7.42	5.15
261893 a	.50	1.17	1.55	6.02	4.42	5.07	6.12	3.55
261893 b	1.00	1.30	2.25	4.07	3.42	4.47	6.05	3.25
261906	.77	1.40	1.50	4.97	3.62	5.50	6.70	4.47
525-F	.70	3.02	3.35	7.00	6.62	6.72	8.60	8.17
203397	.55	1.40	2.00	3.90	3.17	3.57	5.15	6.17
261893 c	.57	.90	1.57	5.50	4.07	4.47	8.17	3.67
162539	1.32	3.15	4.62	4.77	4.95	4.37	5.70	4.72
196660	.30	1.57	1.85	5.15	2.75	3.10	4.25	3.40
196677	.72	1.37	1.95	1.60	2.02	2.97	5.30	3.82
203396	.77	1.40	2.27	5.17	3.22	3.05	5.30	4.57
109839 a	.30	1.02	1.50	3.70	2.77	3.05	2.85	2.37
109839 b	.52	1.10	1.65	1.60	2.72	2.67	3.37	2.87
300947	.32	1.37	1.62	4.32	3.12	3.92	4.05	3.40
262090	.97	1.15	2.20	5.42	3.90	4.05	6.22	5.35
Florigiant	.64	3.12	3.52	7.52	3.65	9.37	13.20	13.20
Florunner	.87	1.70	3.25	4.00	6.07	6.07	8.85	8.85
F_6-439	.37	1.65	.85	1.55	2.85	3.60	6.10	4.62
F^6x 121067	.45	1.25	1.62	3.95	2.95	3.57	4.55	3.17
121067 x F	.52	1.15	.87	2.77	3.12	3.27	5.22	3.22
F_6-203396	.35	1.70	1.22	3.17	2.90	2.70	4.67	4.90
F_6^6-306230	.77	1.17	2.17	1.15	2.02	2.32	3.02	2.42
Min. No. les.	.12	.52	.67	1.15	1.60	1.72	2.10	1.55
Max. No. les.	1.32	5.55	6.22	8.37	9.37	9.37	14.47	13.20
Avg. No. les.	.59	1.54	2.22	3.78	3.47	3.89	5.54	4.54

* Periods computed for analisis of variance.

Table . X

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. arachidicola*-lesions per leaflet at Gainesville in 1979.

Cultigens	------------- Days after planting -------------						
	49	80	93	100	107	114	121
196604	.35	1.82	2.07	2.42	1.57	4.37	3.25
196652	.55	1.75	3.05	3.07	3.05	5.77	3.30
196666	.52	2.62	2.30	2.75	1.82	4.47	3.75
196673	.37	2.05	4.00	5.11	3.37	6.22	4.57
306222	.31	1.42	3.10	3.80	1.32	7.02	3.30
306230 a	.10	1.59	1.70	2.42	1.05	2.45	3.40
306230 b	.40	1.45	1.95	2.17	1.05	2.57	2.67
NC 3033	.37	2.30	1.80	2.27	1.40	3.97	4.42
FESR-5	.85	10.27	16.60	13.75	12.02	13.45	8.77
196658	.47	4.93	7.40	5.27	6.92	5.67	7.27
203395	.35	2.70	5.50	5.55	3.23	7.50	7.97
261893 a	.45	3.42	6.75	5.40	6.80	5.18	4.12
261893 b	.32	2.55	6.22	6.12	6.55	4.92	4.60
261906	.62	3.37	6.15	5.07	5.97	4.55	4.45
3525-F	.95	5.00	11.90	7.82	9.12	12.70	10.62
203397	.45	2.85	4.65	7.23	5.86	5.82	7.47
261893 c	.27	2.22	6.20	5.10	4.30	4.72	3.87
162539	.42	6.28	6.42	7.27	6.58	9.52	7.44
196660	.35	1.75	3.72	3.77	2.60	7.07	5.40
196677	.42	1.70	2.00	3.70	1.32	4.72	4.12
203396	.37	2.92	4.22	5.82	2.97	5.67	7.80
109839 a	.50	1.97	3.40	3.60	1.12	4.42	3.15
109839 b	.47	1.17	2.90	2.32	2.16	4.37	2.50
300947	.80	2.45	4.02	3.95	1.77	4.99	4.60
262090	.77	2.65	6.57	7.75	3.97	7.20	6.82
Florigiant	.95	7.70	8.82	10.85	10.52	13.87	14.85
Florunner	.50	5.00	4.27	4.45	3.05	10.05	11.05
F_6-439	.32	1.67	4.92	4.60	2.62	6.55	6.97
F x 121067	.37	1.82	2.77	3.30	3.28	5.45	6.02
121067 x F	.37	1.32	3.07	2.77	2.22	5.32	3.75
F_6-203396	.35	2.72	4.57	3.70	3.25	5.55	4.85
F_6-306230	.70	2.92	2.22	3.37	1.27	4.92	4.46
Max. No. les.	.80	10.27	16.60	13.75	12.02	13.87	14.85
Min. No. les.	.10	1.17	1.70	2.17	1.05	2.45	2.50
Avg. No. les.	.48	2.98	4.83	4.89	3.88	6.29	5.67

Table XI

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. arachidicola*-lesions per leaflet at Marianna in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	1.85	.60	.97	1.10	.50	1.00
196652	.00	2.17	.70	2.65	1.77	.82	.85
196666	.00	2.27	1.00	1.65	1.42	1.02	.60
196673	.00	3.02	1.40	4.05	2.90	1.10	3.25
306222	.02	2.20	1.42	3.32	2.35	.85	2.15
306230 a	.00	1.35	.72	1.10	.87	.30	.50
306230 b	.00	1.55	.90	.70	.75	.45	.20
NC 3033	.00	3.90	1.75	1.37	2.97	1.45	1.45
FESR-5	.05	6.97	6.90	11.77	15.90	9.85	14.90
196658	.05	3.70	2.92	4.30	3.27	3.51	5.55
203395	.00	3.20	3.10	3.77	11.67	9.55	5.52
261893 a	.00	3.82	3.75	4.70	4.95	4.02	5.92
261893 b	.00	3.82	4.45	6.47	4.92	6.22	7.57
261906	.02	4.15	4.17	5.77	5.12	5.82	10.80
3525-F	.25	5.47	4.30	8.85	7.27	3.85	7.20
203397	.05	3.87	2.07	5.17	10.37	11.15	5.30
261893 c	.00	2.85	3.75	4.54	4.57	4.20	5.90
162539	.02	5.72	2.77	8.30	4.55	3.20	7.60
196660	.02	2.37	.85	3.65	1.64	.95	2.52
196677	.00	2.57	1.15	2.82	2.24	.90	.65
203396	.00	3.47	1.97	6.60	16.67	10.35	5.87
109839 a	.02	2.20	.27	1.60	1.90	.62	1.05
109839 b	.00	1.57	.22	1.72	1.30	.87	.82
300947	.00	1.85	1.05	1.02	3.05	.82	2.15
262090	.00	3.27	2.32	5.87	3.52	3.20	4.97
Florigiant	.02	5.25	4.15	7.07	9.61	575	6.75
Florunner	.02	4.80	1.65	2.35	4.44	4.17	2.75
F_6-439	.07	2.80	.65	6.62	3.47	3.92	4.77
F x 121067	.05	2.92	1.05	2.47	4.56	2.32	1.40
121067 x F	.00	1.12	.85	.82	1.27	1.05	.87
F_6-203396	.00	3.10	1.22	3.52	2.40	3.95	4.32
F_6-306230	.00	2.62	.95	.77	1.82	.85	.65
Max. No les.	.25	6.97	6.90	8.85	16.67	11.15	14.90
Min. No. les.	.00	1.12	.22	.70	.75	.30	.20
Avg. No. les.	.02	3.14	1.93	3.95	4.52	3.39	3.93

Table XII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. arachidicola*-lesions per leaflet over locations and seasons at Gainesville and Marianna in the combined 1978 and 1979 seasons.

Cultigens	49	80	93	100	107	114	121
196604	.16	1.58	1.17	1.77	1.58	2.61	1.99
196652	.28	1.39	2.27	2.22	2.51	3.02	2.51
196666	.28	2.03	1.56	2.37	1.89	2.88	2.92
196673	.69	2.06	2.32	3.95	3.22	4.16	4.52
306222	.20	1.61	2.35	3.09	2.35	3.27	2.99
306230 a	.16	1.20	1.24	1.61	1.38	1.61	1.84
306230 b	.22	1.24	1.45	1.72	1.12	1.82	1.41
NC 3033	.28	3.00	1.96	2.01	2.71	2.52	2.86
FESR-5	.50	6.31	4.68	10.72	11.73	12.03	10.20
196658	.18	3.11	3.75	4.00	4.62	4.66	5.44
203395	.30	2.31	3.36	3.98	5.43	6.99	5.68
261893 a	.27	2.31	4.40	4.48	5.12	4.71	4.56
261893 b	.37	2.03	3.97	4.45	4.85	5.15	4.87
261906	.39	2.48	4.02	4.19	4.98	5.29	6.45
3525-F	.51	3.61	6.61	7.28	7.06	8.61	8.26
203397	.31	2.39	2.92	4.17	5.52	6.25	5.53
261893 c	.25	3.75	4.12	3.89	4.04	5.45	4.19
162539	.48	4.58	4.21	6.15	5.02	4.67	6.22
196660	.19	1.51	2.51	3.15	2.51	3.85	3.64
196677	.32	1.80	1.62	2.84	2.36	3.44	2.76
203396	.33	2.31	2.99	3.03	5.46	5.85	5.29
109839 a	.24	1.52	2.24	2.72	2.24	2.33	2.33
109839 b	.28	2.29	1.39	2.15	1.92	2.85	2.06
300947	.30	1.59	2.62	2.71	2.84	3.03	3.34
262090	.47	2.13	3.95	5.07	3.65	5.16	5.72
Florigiant	.50	4.94	6.55	7.64	11.66	10.29	11.11
Florunner	.44	3.41	3.06	3.91	4.14	7.44	7.33
F_6-439	.43	1.42	2.07	3.00	2.77	4.72	4.94
F x 121067	.27	1.77	2.42	2.85	3.65	3.87	3.36
121067 x F	.27	.99	2.03	2.28	1.93	3.52	2.37
F_6-203396	.20	1.81	2.55	2.98	2.45	4.16	4.44
F_6-306230	.43	2.00	1.29	2.27	1.73	2.71	2.19
Max. No. les.	.69	6.31	6.61	10.72	11.73	12.03	11.11
Min. No. les.	.16	.99	1.17	1.61	1.12	1.61	1.41
Avg. No. les.	.33	2.39	2.93	3.71	3.89	4.65	4.48

Table XIII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. personatum*-lesions per leaflet at Gainesville in 1978.

Cultigens	Days after planting										
	48*	71	78*	85	92*	99*	106*	113*	120*	127	134
196604	.00	.00	.05	.27	.20	.27	2.25	2.22	2.82	4.47	3.82
196652	.00	.00	.15	.20	.25	1.08	1.42	4.00	3.75	5.97	3.30
196666	.00	.02	.05	.27	.25	.72	1.95	3.25	3.20	4.12	1.60
196673	.00	.00	.07	.12	.15	.00	2.25	3.22	2.10	3.55	2.95
306222	.00	.10	.07	.45	1.25	4.00	5.50	10.12	8.10	9.07	4.27
306230 a	.00	.00	.10	.00	.27	.85	.85	2.20	3.40	4.35	4.90
306230 b	.00	.00	.02	.05	.17	.47	2.30	3.22	4.57	2.52	2.92
NC 3033	.00	.15	.22	.22	1.40	1.85	8.15	7.75	10.10	12.62	7.20
FESR-5	.00	.00	.00	.02	.02	.00	.02	.02	.00	.00	.25
196658	.00	.02	.02	.05	.10	.10	1.77	1.57	.17	.25	2.45
203395	.00	.00	.00	.00	.00	.10	.37	.95	.27	1.15	.92
261893 a	.00	.00	.00	.05	.00	.00	.25	.40	.00	.00	.00
261893 b	.00	.00	.00	.02	.00	.00	.05	.15	.00	.00	.05
261906	.00	.00	.00	.00	.00	.00	.12	.35	.60	.00	.30
3525-F	.00	.05	.00	.10	.05	.37	1.12	.60	.52	.02	1.50
203397	.00	.00	.00	.00	.00	.02	.00	.00	.12	.10	.40
261893 c	.00	.00	.00	.00	.00	.00	.52	.27	.00	.00	.00
162539	.00	.00	.02	.02	.00	.00	2.20	1.72	.40	.90	.85
196660	.00	.02	.02	.00	.12	.25	.65	2.32	1.80	4.07	4.05
196677	.00	.05	.05	.07	.12	.77	1.52	3.67	2.82	4.15	3.72
203396	.00	.02	.12	.00	.17	.25	1.07	.87	1.55	2.47	1.72
109839 a	.00	.10	.00	.02	.37	.42	1.50	4.20	3.77	6.52	5.70
109839 b	.00	.05	.05	.02	.10	.17	2.40	3.37	4.02	5.47	3.67
300947	.00	.00	.05	.07	.15	.25	1.05	4.22	5.10	6.12	5.45
262090	.00	.00	.00	.07	.02	.00	.25	.05	.00	.00	.27
Florigiant	.00	.00	.02	.05	.17	.15	.37	1.82	.70	.92	1.12
Florunner	.00	.02	.12	.22	.55	1.85	2.82	3.67	.82	2.50	2.00
F_6-439	.00	.00	.00	.00	.02	.00	.60	2.90	.22	1.02	1.27
F x 121067	.00	.00	.02	.07	.02	.12	1.07	2.87	2.40	3.80	4.80
121067 x F	.00	.05	.05	.07	.50	.62	2.45	3.72	2.95	5.07	4.15
F_6-203396	.00	.00	.00	.00	.00	.12	.30	.40	1.25	1.40	.57
F_6-306230	.00	.05	.00	.15	.55	3.00	4.15	6.10	6.27	6.72	4.32
Min. No. les.	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Max. No. les.	.00	.15	.15	.45	1.40	4.00	8.15	10.12	10.10	12.62	7.20
Avg. No. les.	.00	.02	.04	.08	.21	.56	1.60	2.57	2.31	3.10	2.51

* = Periods computed for analysis of variance.

Table XIV

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. personatum*-lesions per leaflet at Marianna in 1978.

Cultigens	Days after planting							
	52*	66	80*	94*	100*	107*	114*	121*
196604	.00	.25	.15	.60	1.00	.75	.75	5.30
196652	.00	.00	.60	.75	2.80	3.35	4.37	6.55
196666	.00	.00	.12	.32	.62	.32	.45	2.97
306222	.00	.00	.45	1.92	2.70	2.00	2.42	4.47
306230 a	.00	.00	.30	.40	2.40	2.77	2.32	5.42
306230 b	.00	.15	.25	1.22	2.25	1.37	2.27	4.30
NC 3033	.00	.00	.57	2.60	4.52	6.25	9.97	11.37
FESR-5	.00	.00	.05	.00	.12	.55	.00	.00
196658	.00	.00	.00	.00	.00	.00	.00	.00
203395	.00	.25	.05	.27	.00	.87	.30	.72
261893 a	.00	.00	.12	.00	.00	.00	.00	.00
261893 b	.00	.00	.00	.00	.00	.00	.00	.00
261906	.00	.00	.05	.05	.05	.02	.00	.00
3525-F	.00	.00	.17	.12	.35	.25	.27	.22
203397	.00	.00	.07	.10	.12	.12	.37	.05
261893 c	.00	.00	.10	.00	.00	.00	.00	.00
162539	.00	.00	.00	.00	.90	.17	.22	.62
196660	.00	.00	.17	.70	.60	.25	2.52	3.90
196666	.00	.00	.35	.77	2.02	1.92	3.92	5.87
196677	.00	.00	.25	.57	1.35	1.77	3.17	6.82
203396	.00	.00	.07	.12	.00	.00	.20	.50
109839 a	.00	.00	.35	.37	2.10	2.35	3.60	5.02
109839 b	.00	.00	.20	.52	.85	.52	3.20	6.32
300947	.00	.00	.15	.57	1.07	1.02	3.05	5.90
262090	.00	.00	.22	.00	.00	.00	.00	.25
Florigiant	.00	.02	.07	.25	.47	.52	1.15	1.15
Florunner	.00	.00	.12	.27	.97	1.25	4.67	4.67
F_6-439	.00	.00	.00	.27	.55	.15	1.82	2.32
F^6x 121067	.00	.00	.17	.30	1.37	2.45	3.60	6.40
121067 x F	.00	.00	.17	1.30	1.85	1.17	3.20	4.82
F_6-203396	.00	.00	.00	.35	.62	.15	.90	1.95
F^6_6-306230	.00	.00	.75	1.92	6.92	6.07	5.72	8.87
Min. No. les.	.00	.00	.00	.00	.00	.00	.00	.00
Max. No. les.	00	.25	.65	2.60	6.92	6.25	9.97	11.37
Avg. No. les.	00	.02	.18	.56	1.17	1.20	2.01	3.34

* = Periods computed for analysis of variance.

Table XV

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. personatum*-lesions per leaflet at Gainesville in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	2.40	9.00	9.47	9.82	3.67	15.82
196652	.00	3.17	6.95	11.32	8.87	7.27	23.45
196666	.00	3.17	12.02	13.82	5.87	7.57	17.17
196673	.00	2.02	12.74	11.01	4.95	2.07	14.85
306222	.00	3.60	15.75	15.20	10.00	5.27	17.45
306230 a	.07	2.41	8.70	8.62	10.25	3.62	14.22
306230 b	.00	2.05	8.85	13.45	7.27	4.60	12.32
NC 3033	.00	4.07	36.27	25.87	20.12	28.35	30.25
FESR-5	.00	.32	2.59	2.25	.17	.00	1.25
196658	.00	1.20	2.97	3.60	.87	.00	1.50
203395	.00	.87	5.92	3.37	3.00	.32	6.40
261893 a	.00	.25	6.15	.00	1.55	.00	.00
261893 b	.00	.27	3.87	1.12	.00	.37	.00
261906	.00	.45	1.15	.00	.95	.00	.00
3525-F	.00	2.10	3.75	3.45	.90	2.52	4.87
203397	.00	.07	1.32	.23	.59	.27	1.22
261893 c	.00	.00	.45	1.25	.00	.00	.20
162593	.00	2.22	9.42	4.82	4.17	.42	5.60
196660	.00	3.07	10.32	8.02	5.85	1.90	12.32
196677	.00	1.97	9.32	12.50	9.02	5.65	15.72
203396	.00	.25	1.42	.85	2.85	.00	1.60
109839 a	.00	1.67	8.35	7.62	5.40	1.30	15.45
109839 b	.00	2.00	8.60	10.32	6.60	2.30	17.72
300947	.00	2.12	9.22	11.60	6.90	3.52	18.35
262090	.00	.95	2.47	1.17	.90	.00	.00
Florigiant	.00	3.20	14.72	15.77	8.77	2.00	2.15
Florunner	.00	2.62	12.20	14.72	13.20	2.95	3.07
F_6-439	.00	1.00	4.45	4.37	3.10	1.35	4.15
Fx 121067	.00	1.82	8.35	8.20	2.35	1.15	13.95
121067 x F	.00	2.57	8.50	10.07	7.95	7.95	16.15
F_6-203396	.00	.15	2.55	6.52	3.25	1.70	2.17
F_6-306230	.00	2.75	15.75	19.00	14.17	5.72	21.00
Max. No. les.	.00	4.07	36.27	25.87	20.12	28.35	30.25
Min. No. les.	.00	.15	.45	.00	.00	.00	.00
Avg. No. les.	.00	1.77	8.25	8.11	5.61	3.24	9.68

Table XVI

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. personatum*-lesions per leaflet at Marianna in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	2.30	7.67	11.40	19.90	20.20	20.17
196652	.00	4.00	9.80	6.97	27.90	20.07	14.92
196666	.00	2.37	8.67	11.40	22.52	29.02	19.57
196673	.00	2.55	10.75	7.32	23.32	20.42	14.57
306222	.00	3.32	6.90	11.70	19.85	20.42	14.75
306230 a	.00	2.02	8.02	9.05	26.50	20.45	13.75
306230 b	.00	2.72	7.65	11.65	22.92	18.70	11.90
NC 3033	.00	6.22	18.90	15.55	29.92	54.02	30.20
FESR-5	.00	1.02	4.00	1.82	.32	3.37	.80
196658	.00	.60	2.17	1.95	12.44	8.31	5.00
203395	.00	1.00	3.12	3.75	.75	11.20	6.95
261893 a	.00	.05	.10	.37	1.27	3.47	2.10
261893 b	.00	.00	.27	.00	1.95	3.37	.95
261906	.00	.00	.45	.00	1.67	2.55	1.05
3525-F	.00	.87	3.75	3.20	5.00	9.90	5.60
203397	.00	.30	3.27	1.82	.00	.92	5.50
261893 c	.00	.10	.57	.00	.05	5.15	2.17
162539	.00	.37	3.27	.90	6.62	4.97	1.85
196660	.00	1.62	7.50	5.67	19.02	20.20	13.30
196677	.00	2.50	11.27	9.95	20.10	31.82	19.35
203396	.00	.67	4.25	.70	.00	1.17	4.55
109839 a	.00	2.30	8.15	7.02	17.57	22.87	12.07
109839 b	.00	2.27	7.07	7.22	16.52	18.87	8.75
300947	.00	2.45	8.42	10.72	21.00	31.87	16.85
262090	.00	.30	2.22	.62	5.62	5.82	4.32
Florigiant	.00	1.45	5.37	5.45	3.43	14.85	5.55
Florunner	.00	2.70	12.42	10.60	8.26	23.52	11.32
F_6-439	.00	.82	3.70	2.75	11.95	16.67	9.20
F x 121067	.00	3.87	7.85	6.42	18.07	16.85	13.75
121067 x F	.00	3.30	7.12	13.52	25.22	22.62	17.45
F_6-203396	.00	,15	2.45	2.25	7.65	5.57	5.90
F_6-306230	.00	3.35	9.60	10.80	17.32	26.55	12.85
Max. No. les.	.00	6.22	18.90	13.52	29.92	54.02	30.20
Min. No. les.	.00	.00	.10	.00	.00	.92	.80
Avg. No. les.	.00	1.80	6.15	6.08	12.99	16.44	10.32

Table XVII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Number of *C. personatum*-lesions per leaflet over locations and seasons at Gainesville and Marianna in the combined 1978 and 1979 seasons.

Cultigens	Days after planting						
	40	80	93	100	107	114	121
196604	.00	1.25	4.70	5.53	8.18	6.70	11.02
196652	.00	1.97	3.72	5.54	10.38	8.92	9.66
196666	.00	1.98	5.42	6.49	8.06	10.93	11.45
196673	.00	1.18	5.98	4.73	7.70	6.53	8.62
306222	.00	1.86	6.42	8.40	9.33	9.54	11.19
306230 a	.01	1.20	4.34	5.22	10.09	8.64	9.19
306230 b	.00	1.25	4.47	6.95	8.46	7.19	8.27
NC 3033	.00	2.75	14.79	11.94	16.11	25.02	20.47
FESR-5	.00	.34	1.65	1.04	.26	.84	.51
196658	.00	.45	1.31	1.41	3.76	2.46	1.66
203395	.00	.47	2.32	1.80	1.24	3.19	3.58
261893 a	.00	.10	1.56	.09	.76	.96	.52
261893 b	.00	.06	1.03	.28	.49	.87	.23
261906	.00	.12	.41	.01	.69	.72	.41
3525-F	.00	.78	1.91	1.84	1.81	3.32	2.80
203397	.00	.10	1.19	.59	.17	.38	1.72
261893 c	.00	.05	.25	.31	.14	1.35	.59
162539	.00	.65	3.17	1.65	3.28	1.83	2.11
196660	.00	1.35	4.66	3.62	6.44	6.73	7.83
196677	.00	1.19	5.31	6.14	8.10	11.07	11.17
203396	.00	.27	1.48	.44	.97	.55	2.04
109839 a	.00	1.07	4.31	4.29	6.70	7.99	10.07
109839 b	.00	1.17	4.07	4.64	6.51	6.93	9.22
300947	.00	1.19	4.59	5.91	7.49	10.66	11.55
262090	.00	.36	1.17	.44	1.69	1.46	1.14
Florigiant	.00	1.18	5.12	5.46	3.27	4.95	2.38
Florunner	.00	1.39	6.36	7.03	6.23	8.70	4.96
F_6-439	.00	.45	2.10	1.91	3.94	5.43	3.97
F x 121067	.00	1.46	4.13	4.02	5.98	6.11	9.12
121067 x F	.00	1.49	4.36	6.25	9.19	9.37	10.34
F_6-203396	.00	.07	1.33	2.37	2.81	2.14	2.81
F_6-306230	.00	1.71	6.95	9.93	10.42	11.01	12.19
Max. No. les.	.00	2.75	14.79	11.94	16.11	25.02	20.47
Min. No. les.	.00	.05	.25	.01	.14	.55	.23
Avg. No. les.	.00	.97	3.72	3.96	5.33	6.01	6.33

Table XVIII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Size (0 in mm) of *C. arachidicola*-lesions per leaflet at Gainesville in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.50	1.75	1.30	1.20	.75	1.00	1.20
196652	.75	1.15	1.40	1.60	.75	1.00	1.40
196666	.75	1.50	1.00	1.50	1.00	1.00	1.20
196673	.50	1.80	1.80	1.70	.75	1.20	1.80
306222	.50	1.50	1.50	1.45	.50	1.00	1.20
306230 a	.50	1.30	1.00	1.40	1.00	1.00	1.20
306230 b	.50	1.00	1.00	1.30	1.00	1.00	1.40
NC 3033	.50	1.70	1.35	1.40	1.00	.75	1.10
FESR-5	.50	1.80	2.00	1.70	1.00	1.00	1.65
196658	.50	1.70	1.60	1.50	1.00	1.50	1.30
203395	.50	1.20	1.30	1.50	1.00	1.00	1.45
261893 a	.50	1.80	1.70	2.00	1.20	1.75	1.80
261893 b	.50	1.80	2.00	1.00	1.20	1.60	1.80
261906	.75	1.60	1.80	2.00	1.35	1.85	1.55
3525-F	.75	2.20	2.30	1.70	1.20	1.50	2.20
203397	.50	1.25	1.30	1.35	1.15	1.00	1.30
261893 c	.50	1.90	1.90	1.80	1.00	1.50	1.70
162539	.50	1.70	1.90	1.50	1.00	1.00	1.45
196660	.50	1.30	1.00	1.60	.50	1.00	1.75
196677	.50	1.40	1.46	1.85	1.00	1.00	1.65
203396	.50	1.00	1.60	1.40	.50	1.00	1.15
109839 a	.75	1.80	1.90	1.70	1.00	1.20	1.20
109839 b	.50	1.30	1.70	1.40	.75	1.40	1.55
300947	.50	1.50	1.90	1.70	1.00	1.30	1.75
262090	.75	1.60	1.90	1.90	1.70	1.50	1.50
Florigiant	.50	2.30	2.40	2.20	1.75	1.20	1.25
Florunner	.50	1.70	2.00	1.85	1.00	1.30	1.35
F_6-439	.50	1.00	1.30	1.40	1.30	1.30	1.30
F x 121067	.75	1.30	1.80	1.70	1.00	1.30	1.40
121067 x F	.50	1.00	1.60	1.45	.75	1.20	1.10
F_6-203396	.50	1.50	1.35	1.35	.50	1.00	1.35
F_6-306230	.50	1.80	1.50	1.65	.75	1.20	1.40
Max. les. size	.75	2.20	2.40	2.20	1.70	1.85	1.80
Min. les. size	.50	1.00	1.00	1.00	.50	.75	1.10
Avg. les. size	.55	1.50	1.60	1.60	1.00	1.20	1.48

Table XIX

Field screening for resistance to Cercospora leafspot diseases of peanuts. Size (Ø in mm) of *C. arachidicola*-lesions per leaflet at Marianna in 1979.

Cultigens	Days after planting						
	49	80	93	100	117	114	121
196604	.00	1.70	.50	.50	.75	.75	.50
196652	.00	1.50	1.00	1.20	1.00	.75	.50
196666	.00	1.80	.20	1.00	1.00	1.00	.75
196673	.00	2.00	1.50	1.20	1.30	1.60	1.40
306222	.50	1.90	2.20	1.00	1.30	1.00	.80
306230 a	.00	1.75	1.00	.50	1.00	.50	.50
306230 b	.00	1.80	1.00	.50	.75	.50	.50
NC 3033	.00	2.00	1.50	1.20	1.00	1.50	1.00
FESR-5	.50	2.50	2.00	2.00	2.00	2.50	1.95
196658	.50	2.00	1.00	1.80	1.00	1.00	1.35
203395	.00	1.80	1.20	1.00	.75	.75	1.35
261893 a	.00	2.25	1.80	1.80	1.90	1.50	1.50
261893 b	.00	2.40	1.50	1.80	1.90	1.50	1.70
261906	.50	2.40	1.50	1.60	1.80	1.70	1.55
3525-F	.00	2.40	2.50	1.80	2.20	2.60	2.30
203397	.50	1.40	1.20	1.00	1.00	1.00	1.40
261893 c	.00	2.30	1.20	1.60	1.80	1.50	1.45
162539	.50	2.20	1.50	1.00	1.90	1.70	1.20
196660	.50	2.20	1.00	1.25	1.00	1.70	.70
106677	.00	1.75	1.20	1.00	1.00	1.50	.75
203396	.00	1.50	1.20	.75	1.20	1.20	1.40
109839 a	.50	1.75	.50	1.00	1.00	1.00	.50
109839 b	.00	1.50	.50	1.00	1.20	1.00	.50
300947	.00	1.80	1.40	1.00	1.60	1.20	.60
262090	.00	2.20	1.40	1.20	1.20	1.70	1.35
Florigiant	.50	2.30	3.00	1.50	2.00	3.00	2.25
Florunner	.50	1.90	2.00	1.20	1.80	1.75	1.60
F_6-439	.75	1.70	.75	1.00	1.00	1.30	1.15
F x 121067	.50	1.70	1.00	1.20	1.50	1.50	1.00
121067 x F	.00	1.60	1.20	.50	.50	1.00	.80
F_6-203396	.00	1.90	1.00	1.00	1.00	1.30	1.15
F_6-306230	.00	1.70	1.20	.50	1.00	1.30	.80
Max. les. size	.75	2.50	3.00	2.00	2.20	3.00	2.30
Min. les. size	.00	1.40	.50	.50	.75	.50	.50
Avg. les. size	.50	1.90	1.30	1.15	1.30	1.40	1.13

Table XX

Field screening for resistance to Cercospora leafspot diseases of peanuts. Size (Ø in mm) of *C. personatum*-lesions per leaflet at Gainesville in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	.75	1.20	.75	.75	.50	.50
196652	.00	1.00	1.20	1.00	.50	.50	.50
196666	.00	1.00	1.40	1.00	.75	.50	.75
196673	.00	1.00	1.60	1.00	.50	.50	.50
306222	.00	1.40	1.40	1.00	.50	.50	.75
306230 a	.00	.75	1.40	1.00	1.20	.50	.75
306230 b	.00	.75	1.30	1.00	1.00	.50	.75
NC 3033	.00	1.60	1.90	1.50	1.20	.75	.75
FESR-5	.00	.50	.75	.75	.50	.00	.50
196658	.00	.50	.50	.50	.50	.00	.50
203395	.00	.50	.75	.50	.50	.50	.50
261893 a	.00	.50	.75	.00	.50	.00	.00
261893 b	.00	.50	.50	.50	.00	.50	.00
261906	.00	.50	.50	.00	.50	.00	.00
3525-F	.00	.75	.75	.75	.50	.50	.50
203397	.00	.50	.50	.50	.50	.50	.50
261893 c	.00	.50	.50	.50	.00	.00	.50
162539	.00	.75	1.20	.70	.50	.50	.75
196660	.00	.75	1.20	1.00	.50	.50	.50
196677	.00	1.00	1.30	1.00	.50	.50	.50
203396	.00	.50	.50	.50	.50	.00	.50
109839 a	.00	1.00	1.50	.75	.50	.50	1.00
109839 b	.00	.75	1.40	1.00	.75	.50	.75
300947	.00	.75	1.30	1.00	.75	.50	.50
262090	.00	.50	.50	.50	.50	.00	.50
Florigiant	.00	1.00	1.50	1.00	.50	.50	.50
Florunner	.00	1.00	1.50	1.00	1.00	.50	.50
F_6-439	.00	.50	1.00	.50	.50	.50	.50
F x 121067	.00	.75	1.70	1.00	.50	.50	.75
121067 x F	.00	1.00	1.20	1.00	.75	.50	.50
F_6-203396	.00	.50	.75	.50	.50	.50	.50
F_6-306230	.00	.75	1.80	1.00	.00	.50	.75
Max. les. size	.00	1.60	1.90	1.50	1.20	.75	1.00
Min. les. size	.00	.50	.50	.00	.00	.00	.00
Avg. les. size	.00	.75	1.10	.75	.50	.50	.50

Table XXI

Field screening for resistance to Cercospora leafspot diseases of peanuts. Size (Ø in mm) of *C. personatum*-lesions per leaflet at Marianna in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	1.00	1.40	.75	.50	1.20	1.00
196652	.00	1.00	1.30	.50	.50	1.40	1.00
196666	.00	1.30	1.70	.50	.50	1.60	1.20
196673	.00	1.30	1.80	.75	.75	1.60	1.20
306222	.00	1.20	1.90	.50	.75	1.80	1.20
306230 a	.00	1.30	1.80	.75	.75	1.30	1.00
306230 b	.00	1.30	1.60	1.00	.50	1.20	1.50
NC 3033	.00	1.50	2.00	1.40	.75	1.90	1.80
FESR-5	.00	1.00	1.50	.50	.50	.75	.50
196658	.00	.50	.50	.50	.50	1.00	.50
203395	.00	.50	1.00	.50	.50	.75	.75
261893 a	.00	.50	.50	.50	.50	.50	.50
261893 b	.00	.00	.50	.00	.50	.50	.50
261906	.00	.00	.50	.00	.50	.50	.50
3525-F	.00	.75	1.30	.50	.50	1.00	1.00
203397	.00	.50	1.00	.50	.00	.50	.75
261893 c	.00	.50	.50	.00	.50	.50	.50
162539	.00	.50	1.20	.50	.50	.75	.50
196660	.00	.50	1.60	.50	.50	1.50	1.00
196677	.00	1.00	1.70	.50	.50	1.70	1.50
203396	.00	.50	1.00	.50	.00	.50	.50
109839 a	.00	1.00	1.20	.50	.50	1.90	1.00
109839 b	.00	1.00	1.60	.50	.50	1.60	1.00
300947	.00	1.30	1.70	1.00	.50	1.60	1.20
262090	.00	.50	.50	.50	.50	.50	.50
Florigiant	.00	.75	1.60	.75	.50	1.00	1.00
Florunner	.00	1.00	2.30	1.30	.50	1.40	1.40
F_6-439	.00	.75	1.40	1.50	.50	1.50	1.00
F x 121067	.00	1.50	1.70	.50	1.00	1.70	1.20
121067 x F	.00	1.30	1.70	1.00	.50	1.50	1.50
F_6-203396	.00	.50	1.20	.50	.50	1.00	1.00
F_6-306230	.00	1.50	1.70	1.00	.50	1.70	1.50
Max. les. size	.00	1.50	2.30	1.40	1.00	1.90	1.80
Min. les. size	.00	.00	.50	.00	.00	.50	.50
Avg. les. size	.00	.85	1.30	.50	.50	1.20	1.00

Table XXII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Percent defoliation caused by the complex *C. arachidicola*-*C. personatum* at Gainesville in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	1.0	44.9	62.4	68.7	71.2	82.6	82.4
196652	1.0	45.9	62.6	73.1	76.1	82.1	82.5
196666	1.0	45.3	58.1	71.7	73.6	82.5	80.9
196673	1.0	49.4	66.1	73.1	74.1	84.6	81.1
306222	1.0	44.0	64.4	74.5	78.9	87.2	90.6
306230 a	1.0	38.6	61.2	69.1	68.4	77.9	80.1
306230 b	1.0	48.8	57.6	64.4	72.1	82.4	78.4
NC 3033	1.0	45.2	60.2	71.9	72.4	81.7	81.9
FESR-5	1.0	56.4	69.2	69.1	80.1	88.6	89.7
196658	1.0	51.2	65.6	74.1	69.3	82.7	79.2
203395	1.0	43.8	57.9	68.2	74.2	79.6	81.2
261893 a	1.0	51.2	63.4	73.8	73.0	83.5	84.6
261893 b	1.0	45.9	61.1	77.0	74.1	82.4	82.4
261906	1.0	47.4	63.1	75.1	74.5	84.9	83.7
3525-F	1.0	47.1	63.3	73.8	75.2	85.6	91.4
203397	1.0	38.9	56.6	66.7	67.9	80.4	78.4
261893 c	1.0	49.3	61.3	70.2	72.6	80.9	82.2
162559	1.0	50.7	62.9	74.6	72.3	83.2	81.4
196660	1.0	45.1	59.0	69.7	72.2	81.4	80.4
196677	1.0	46.9	63.4	69.7	74.5	82.0	82.2
203396	1.0	42.1	61.4	69.7	71.4	80.9	79.4
109839 a	1.0	50.2	60.6	72.7	74.3	84.2	82.1
109839 b	1.0	53.0	61.4	70.3	71.4	81.6	82.8
300947	1.0	46.9	62.5	69.4	69.8	83.6	83.4
262090	1.0	44.3	59.7	70.6	73.7	82.8	83.6
Florigiant	1.0	47.9	63.4	74.1	78.7	90.2	92.5
Florunner	1.0	46.6	67.1	72.6	88.1	94.9	98.5
F_6-439	1.0	49.4	61.6	67.2	73.9	80.2	81.2
F x 121067	1.0	49.6	65.7	71.4	77.1	87.9	89.5
121067 x F	1.0	48.9	64.7	71.2	77.4	85.7	83.7
F_6-203396	1.0	43.9	63.3	71.4	70.9	79.6	80.2
F_6-306230	1.0	46.7	64.9	72.3	78.2	88.3	88.2
Max.perc. def,	1.0	56.4	69.2	79.1	88.1	94.9	98.5
Min.perc. def.	1.0	38.6	57.6	66.7	68.4	77.9	78.4
Avg.perc. def.	1.0	47.1	65.4	71.6	74.1	83.9	84.0

Table XXIII

Field screening for resistance to Cercospora leafspot diseases of peanuts. Percent defoliation caused by the complex *C. arachidicola*-*C. personatum* at Marianna in 1979.

Cultigens	Days after planting						
	49	80	93	100	107	114	121
196604	.00	50.4	51.8	66.1	76.1	80.8	83.3
196652	.00	46.1	54.6	73.0	78.9	85.6	82.9
196666	.00	48.4	49.5	68.8	79.6	80.6	84.0
196673	.00	50.1	56.4	73.6	80.1	79.7	83.2
306222	.00	51.3	52.4	67.2	80.2	82.9	81.2
306230 a	.00	49.5	46.9	63.8	80.1	81.3	79.9
306230 b	.00	51.9	49.0	66.8	77.6	78.9	82.7
NC 3033	.00	43.9	49.4	55.4	77.8	81.4	81.7
FESR-5	.00	47.9	54.9	77.1	82.2	82.4	83.9
196658	.00	48.0	51.4	64.0	74.0	79.1	77.1
203395	.00	44.6	50.6	69.1	81.7	84.9	83.1
261893 a	.00	44.1	54.7	74.6	77.7	80.1	80.9
261893 b	.00	45.8	51.1	73.1	78.3	81.4	81.4
261906	.00	47.4	51.1	68.1	77.9	81.2	83.1
3525-F	.00	50.2	52.2	69.1	77.6	83.7	82.7
203397	.00	46.7	50.9	71.9	74.3	78.0	77.6
261893 c	.00	44.8	53.1	71.1	79.5	81.1	84.6
162539	.00	50.2	52.1	71.8	77.5	76.9	84.8
196660	.00	48.7	55.1	65.6	79.8	78.6	80.9
196677	.00	50.3	54.6	74.1	79.3	80.7	82.4
203396	.00	46.9	47.4	72.1	78.6	76.6	81.9
109839 a	.00	52.7	59.0	69.7	77.5	82.3	81.1
109839 b	.00	53.6	55.9	73.7	79.1	83.2	82.0
300947	.00	45.4	56.5	71.9	80.6	81.6	82.9
262090	.00	46.4	49.4	69.1	80.4	76.7	82.9
Florigiant	.00	45.9	55.5	68.6	84.1	84.0	87.9
Florunner	.00	46.8	57.3	77.2	82.9	88.4	91.2
F_6-439	.00	45.9	60.9	70.9	81.2	82.5	84.8
F x 121067	.00	49.5	61.7	74.4	80.9	84.5	84.4
121067 x F	.00	45.9	56.5	66.7	77.2	82.6	85.4
F_6-203396	.00	46.4	50.9	67.9	78.0	79.6	80.8
F_6-306230	.00	49.7	45.7	68.9	77.8	79.7	81.9
Max. perc. def.	.00	52.7	57.3	77.2	82.9	88.4	91.2
Min. perc. def.	.00	44.1	46.9	55.4	74.0	76.6	79.1
Avg. perc. def.	.00	47.9	53.1	69.8	79.0	81.3	82.8

LIST OF REFERENCES

Abdou, Y. A-M. 1966. The source and nature of resistance in *Arachis* L. species to *Mycosphaerella arachidicola* Jenk and *Mycosphaerella Berkeleyii* Jenk., and factors influencing sporulation of these fungi. Microfilm 66-12,907. North Carolina State of the University of N. Carolina at Raleigh, Ph.D., 1966. Agriculture, plant pathology. University Microfilms, Inc., Ann Arbor, Michigan.

Abdou, Y. A-M., W. C. Gregory, and W. E. Cooper. 1974. Sources and nature of resistance to *Cercospora arachidicola* (Hori) and *Cercosporidium personatum* (Beck and Curtis) Deighton in *Arachis* species. Peanut Science 1:6-11.

Aulakh, K. S., R. S. Sandhu, and M. S. Sunar. 1972. Resistance to "tikka" leafspot in groundnut germplasm. Ind. Journ. Agric. Sci. 42:952-955.

Berkeley, M. J. 1875. Notices of North American fungi. Grevielea 3:p.97.

Chahal, A. S., and R. S. Sandhu. 1972. Reaction of groundnut varieties against *Cercospora personata* and *C. arachidicola.* Plant Dis. Reptr. 56:601-603.

Cochran, W. C. 1951. Testing a linear relation among varieties. Biometrics 7:17-32.

Cooper, W. E., and W. C. Gregory. 1960. Radiation-induced leafspot resistant mutants in the peanut (*Arachis hypogaea* L.) Agronomy J. 52:1-4.

Crump, L. S. 1946. The estimation of variance components in analysis of variance. Biometrics Bulletin 2:7-11.

Deighton, R. H. 1967. Studies on Cercospora and related genera. Mycol. Paper 112:p. 71.

Ellis, J. B., and B. M. Everhart. 1885. North American *Cercosporae.* J. Mycol. 1:61-68.

Falconer, D. S. 1976. Introduction to Quantitative Genetics. The Ronald Press Company. New York. Eight Printing. 365 pp.

Garren, K. H., and C. R. Jackson. 1973. Peanut Diseases. *In:* Peanuts-Cultures and Uses. A Symposium. Chap. 13. American Peanut Research and Education Association, Inc., Stillwater, Oklahoma. 684 pp.

Gibbons, R. W. 1966. *Mycosphaerella* leafspots of groundnuts. FAO Plant Protection Bulletin 14:25-30.

Gibbons, R. W. and B. E. Bailey. 1966. Resistance to *Cercospora arachidicola* in some species of *Arachis*. Rhod. Zamb. Mal. J. Agric. Res. 4:9-11.

Gregory, W. C. and M. P. Gregory. 1976. Groundnuts. pp. 151-154. *In*: N. W. Simmonds. (Ed.). Evolution of Crop Plants. Longman Group, Ltd., London

Hammons, R. O. 1973. Genetics of *Arachis hypogaea*. *In*: Peanut-Cultures and Uses. A Symposium. Chap. 4. American Peanut Research and Education Association, Inc., Stillwater, Oklahoma 684 pp.

Hassan, H., and M. K. Beute. 1977. Evaluation to resistance to Cercospora leafspot in peanut germplasm potentially useful in a breeding program. Peanut Science 4:78-83.

Hemingway, J. S. 1955, The prevalence of the two species of Cercospora on groundnuts. Trans. Brit. Mycol. Soc. 38:243-240.

Hemingway, J. S. 1957. The resistance of groundnuts to Cercospora leafspots. Emp. Journ. of Exper. Agric. 25:60-68.

Higgins, B. B. 1935. Breeding peanuts for disease resistance. Report of the 1936 Annual Meeting of the Southern Division of the American Phytopathological Society. *In*: Phytopathology 25:971.

Hori, S. 1917. Studies on a new case of the rot which affects the leaf of the peanut (trans. title). Annual Rept. Nishigara Agr. Expt. Sta., Tokyo. 26-27 pp.

Horsfall, J. G., and R. W. Barratt. 1945. An improved grading system for measuring plant diseases. Phytopathology 35:655.

Husted, L. 1933. Cytological studies of the peanut *Arachis*. I Chromosome number and morphology. Cytologia 5:109-117.

Husted, L. 1936. Cytological studies of the peanut *Arachis*. II Chromosomes number, morphology and behaviour and their application to the origin of cultivated forms. Cytologia 7:396-423.

James, W. C. 1974. Assessments of plant diseases and losses. Ann. Rev. Phytopathol. 12:28-48.

Jenkins, W. A. 1938. Two fungi causing leafspot of peanut. Jour. Agr. Res. 56:317-332.

Littrell, R. H. 1974. Tolerance in *Cercospora arachidicola* to benomyl and related fungicides. Phytopathology 64:1377-1378.

McDonald, D., P. Subrahmanyam, R. W. Gibbons, S. N. Nigam, and D. Nevill. 1979. Breeding of leafspot resistance and leafspot research at ICRISAT. Informal paper for discussion at 11th Annual Meeting of APREA, July 1979. ICRISAT, 1-10=45/46, Chitoki Gardens, Begumpet, Hyderabed-500 016. 6 pp.

Melouk, H. A., and D. J. Banks. 1978. A method of screening peanut genotypes for resistance to Cercospora leafspot. Peanut Science 5:112-114.

Mercer, P. C. 1977. Pests and diseases of groundnuts in Malawi. I. Virus and foliar diseases. Oleagineux 32:483-488.

Miller, L. 1953. Studies of the parasitism of *Cercospora arachidicola* Hori and *Cercospora personata* (B.&C.) Ell. & Ev. Doctoral Dissertations Series Pb. 5548. University of Minnesota.

Mughogho, L. K. 1969. Mycosphaerella leafspot disease of groundnuts in Malawi. Third Eastern African Cereals Conf., Zambia and Malawi, March 1979. Processed Rept., 1-8 pp.

Plaut, J. L., and R. D. Berger. 1980. Development of *Cercosporidium personatum* in three peanut canopy layers. Peanut Science: In Press.

Purrs, G. S. 1962. Peanut diseases. Qd. Agr. Jour. 88:540-553.

Ramakrishna, V., and A. Apparao. 1968. Studies on the tikka disease of groundnut. Indian Phytopathology 21:31-36.

Reyes, G. M., and R. Romasanta. 1940. Varietal susceptibility of peanuts to black spot [*Cercospora personata* (B.&.C.) Ell. & Ev.] Phillipp. Jour. Agr. 11:372-382.

Rothwell, A. 1962. Diseases of groundnuts in Southern Rhodesia. Rhod. Agr. Jour. 59:199-201.

Satterthwaite, F. E. 1946. An approximate distribution of estimates of variance components. Biometrics Bulletin 2:110-114.

Sharief, Y., J. O. Rawlings, and W. C. Gregory. 1978. Estimates of leafspot resistance in three interspecific hybrids of Euphytica 27:741-751.

Smartt, J. 1961. The diseases of groundnuts in Northern Rhodesia. Emp. J. Exp. Agric. 29:79.

Smartt, J. 1965. Cross compatibility relationships between the cultivated peanuts *Arachis hypogaea* L. and other species of the genus *Arachis*. Ph.D. Dissertation, North Carolina State University. 83 pp, 1964. Univ. Microfilms, Ann Arbor, Mich. (Diss. Abstr.) 26:643-644.

Smartt, J., and W. C. Gregory. 1967. Interspecific cross-compatibility between the cultivated peanut *Arachis hypogaea* L. and other members of the genus *Arachis*. Oleagineux 22:455-459.

Smartt, J., W. C. Gregory, and M. P. Gregory. 1978a. The genomes of *Arachis hypogaea*. 1. Cytogenetic studies of putative genome donors. Euphytica 27:665-675.

Smartt, J., W. C. Gregory, and M. P. Gregory. 1978b. The genomes of *Arachis hypogaea*. 2. The implications in interspecific breeding Euphytica 27:677-680.

Soane, J., I.J.A. Ribeiro, O. Paradela, and T. Igue. 1974. Metodos de avaliaçao da incidencia de cercosporiose em cultura de amendoim (*Arachis hypogaea* L.). Bragantia 33:15-19.

Sowell, G., D. H. Smith, and R. O. Hammons. 1976. Resistance of peanut plant introductions to *Cercospora arachidicola*. Plant Dis. Reptr. 60:494-498.

Vanderplank, J. E. 1963. Plant Diseases: Epidemics and control. Academic: New York. 349 p.

Woodroof, N. 1933. Two leafspots of the peanut (*Arachis hypogaea* L.) Phytopathology 23:627-640.

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The author, Teddy Monasterios de La Torre, was born in Potosi, Bolivia, January 1931.

He attended the University of San Simon of Cochabamba, Bolivia, where he attained his degree of Ingeniero Agronomo in 1953. After completion of his studies, he was awarded a grant in 1954 from the Rockefeller Foundation to be trained in potato breeding at Chapingo, Mexico. In 1956 he attended a short course in Potato Seed Production at the University La Molina in Lima, Peru. In 1963, with funds provided by the Swedish Government (NIB) and FAO, he attended a course in Plant Breeding and Genetics at the Swedish Seed Association in Svalov, Sweden, and conducted research on methods of assessing resistance to frost in potatoes. In 1965 the Alexander von Humboldt Stiftung gave him a grant for training in the identification of potato viruses at the Max Planck Institute, Cologne, Germany. Research was carried out on the identification of viruses on primitive forms of Bolivian potatoes.

In his country he was in charge of the potato breeding program at the experiment stations of Belen, La Tamborada, and Toralapa from 1958 to 1968. In 1970 he was appointed head of the agricultural section in feasibility studies of the Abapo-Izozog region and counterpart of the Agrar- und Hydrotechnick Consultants from Germany. In 1975 he was appointed as consultant of Prudencio Claros Ass. for the Abapo-Rositas Project of Feasibility studies for Agricultural Development.

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Representing his country and his university he attended congresses and meetings on genetics, breeding, and production in Sweden, Colombia, Ecuador, and Bolivia.

He published papers on potato production and fertilization, presence of viruses in potatoes, frost resistance in potatoes, and biological cycle of *Liriomyza* sp and its chemical control on potatoes. He also published papers on forage introduction and production in the Abapo-Izozog region, and on the planting of the development of this region.

Since 1973 he is a faculty member at the University Gabriel Rene Moreno in Santa Cruz, Bolivia. In 1977, with funds provided by a grant from USAID under a contract with the Government of Bolivia and the University Gabriel Rene Moreno of Santa Cruz, Bolivia, he initiated his academic studies at the University of Florida, U.S.A., until the attainment of his degree of Doctor of Philosophy in plant breeding and genetics, in March 1980.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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